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Make Wheels and Brakeshoes

Two Foundries Draw Supplies from the Same Stockyard and Are Served by Metal from a Battery of Four Cupolas Charged from a Common Platform

BY PAT DWYER

INSTEAD of waiting for a united demand from a clamorous public for transportation for itself and its various commodities, a group of prominent men organized a company in the late '70s to build a railroad across Canada from St. John on the eastern seaboard to Vancouver on the Pacific. A mutually satisfactory arrangement was entered into with the government of that period and despite some strenuous experiences and national fireworks that threw one party out of power for five years and then returned it, the task of building the railroad was commenced in 1881 and thereafter pushed so vigorously that the last spike was driven in 1885.

In carrying their proposal to a practical and successful conclusion, the promoters not only anticipated a future demand, a demand that actually crystallized in recent years in the construction of a parallel line known first as the Grand Trunk Continental and at present as the Canadian National Railway; but also in opening up the country they actually created a demand for the service they were prepared to supply.

To the student of railroads or even to the man in the street, the history of the two railroad systems offers many interesting points of comparison, but practically none of resemblance. One railroad is, and always has been operated

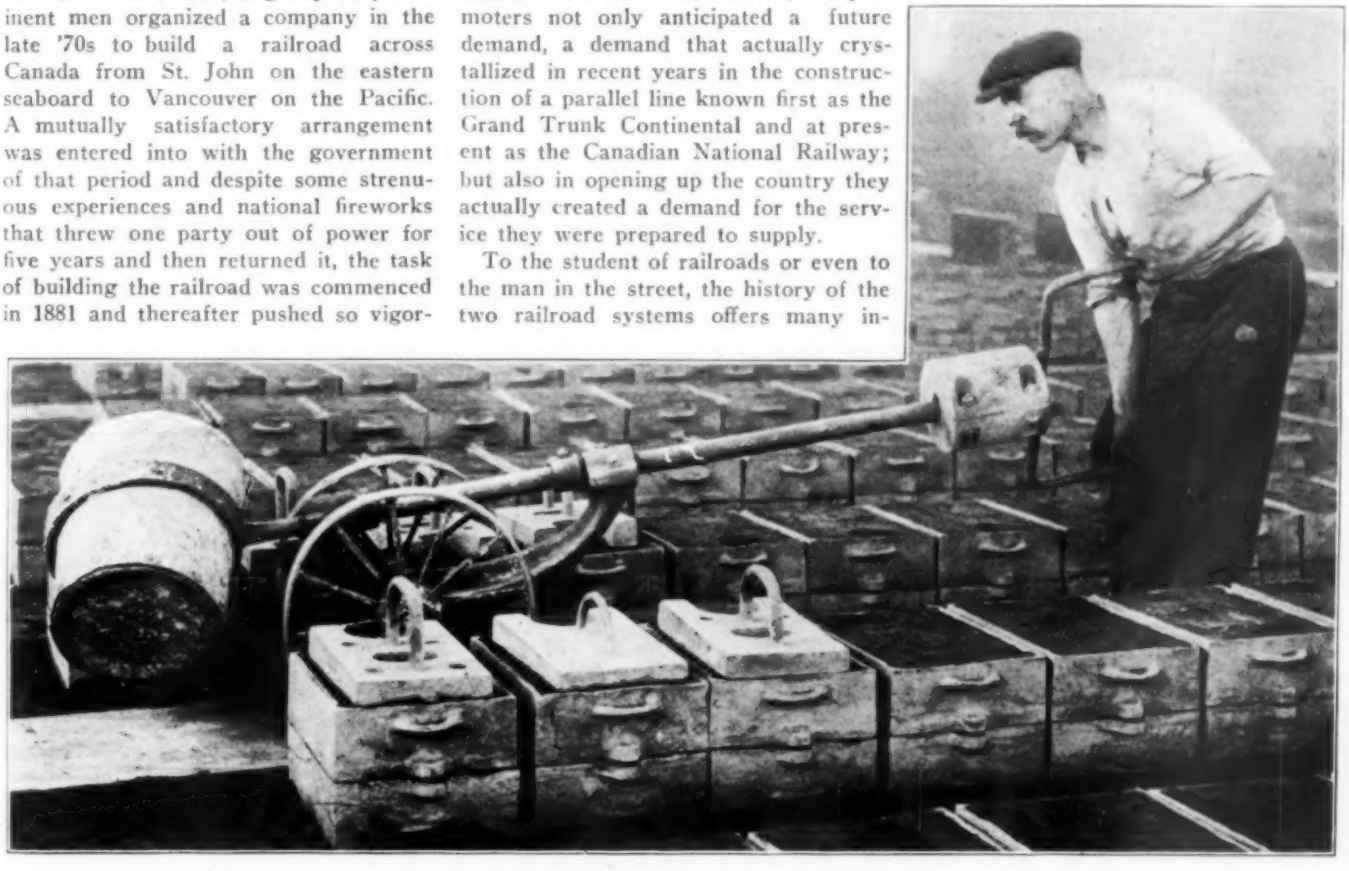


FIG. 1—THE BRAKESHOE MOLDS ARE LAID DOWN IN LONG ROWS BESIDE GANGWAYS PAVED WITH IRON PLATES ON WHICH THE IRON IS CONVEYED IN SMALL BULL LADLES MOUNTED ON AN INGENIOUS TYPE OF TWO-WHEELED CARRIAGE

as a public utility under private control. The other is owned and operated by the government. Last year the Canadian Pacific Railroad Co., paid a dividend—as usual. Last year according to a statement submitted to the House at Ottawa by G. P. Graham, minister of railways and canals, the deficit on the Canadian National railways amounted in round numbers to only $58,000,000 which was considered a gratifying improvement over conditions obtaining the preceding year when the total deficit of the department amounted to something in excess of $64,000,000.

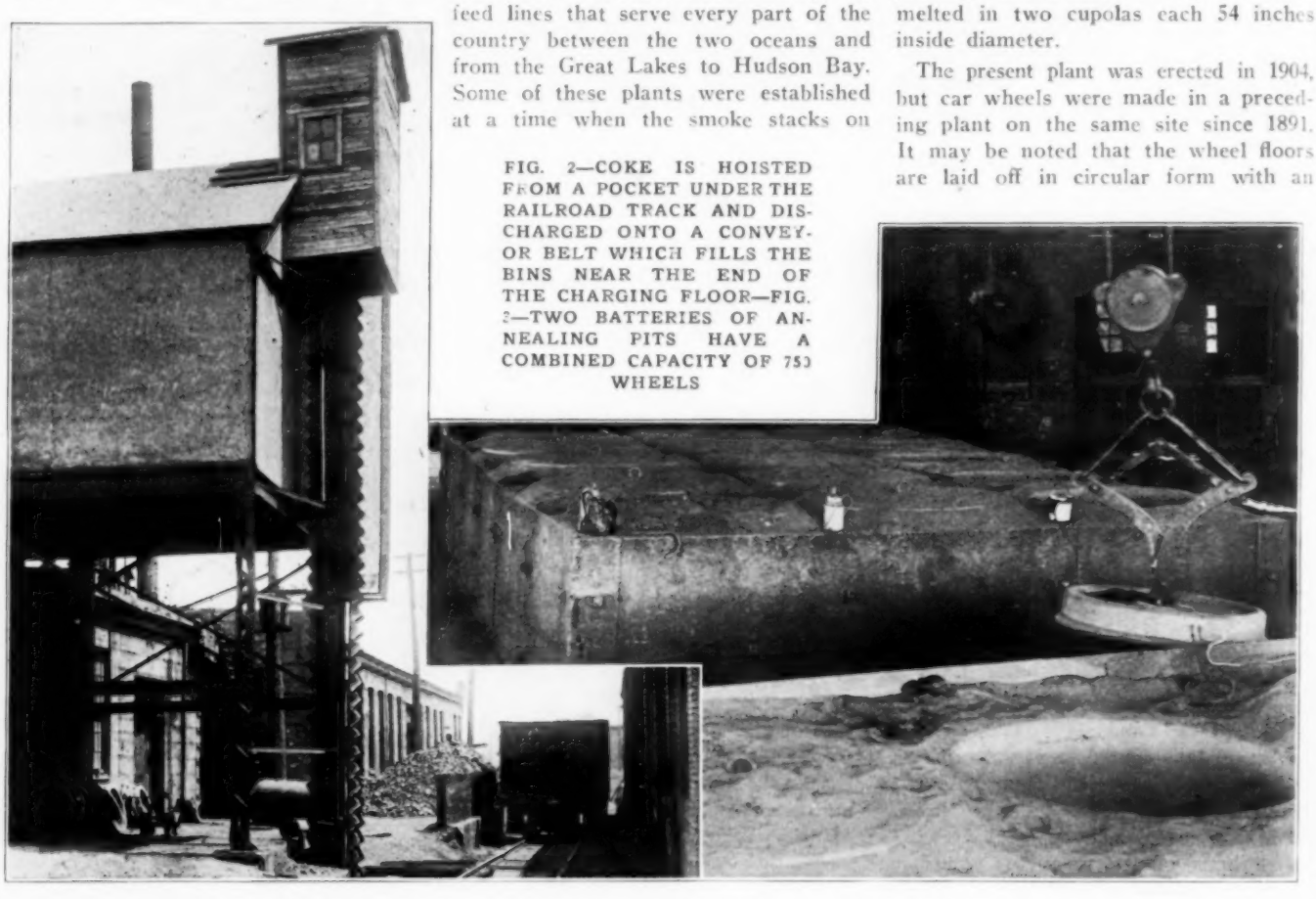


FIG. 2—COKE IS HOISTED FROM A POCKET UNDER THE RAILROAD TRACK AND DISCHARGED ONTO A CONVEYOR BELT WHICH FILLS THE BINS NEAR THE END OF THE CHARGING FLOOR—FIG. 3—TWO BATTERIES OF ANNEALING PITS HAVE A COMBINED CAPACITY OF 750 WHEELS

Long strings of figures and still more tiresome parliamentary reports mean practically nothing to the average person. He reads in his paper that the railroad steadily and consistently shows a deficit at the close of each fiscal year. By the time he has finished reading the paper and even before he has thrown it into the nearest waste basket, he either has forgotten all about the deficit, or he is at a loss to determine whether the report of the honorable minister is submitted as a boast or an apology.

Roads Still Function

However, he cannot fail to note that the railroad continues to function. Trains arrive and depart on time, or within a reasonable time to that set down on the schedule. Thousands of freight cars, loaded and empty, rumble over countless miles of territory and never fail to screech in protest when the brakes are applied to halt or impede their progress.

Constant service infers constant replacement of equipment and it is only natural to find that many plants have been established in Canada for the manufacture of practically all the rolling stock which operates on the two main lines and the network of auxiliary and feed lines that serve every part of the country between the two oceans and from the Great Lakes to Hudson Bay. Some of these plants were established at a time when the smoke stacks on wood-burning locomotives were provided with screens to prevent the sparks from setting fire to the country; when 60-pound rails were looked upon as marvellous rolling mill products and when a sustained run of 100 miles in 5 hours without a breakdown was worthy of a place in the official records. Other plants have been established in recent years, but whether new or old the methods have kept pace with the times and the castings are made to meet the unusually severe specifications which prevail in the railroad industry.

Several foundries erected by different interests at various times now are controlled by Canada Iron Foundries, Ltd., with offices in the Mark Fisher building, Montreal, and with plants at Three Rivers, Que., St. Thomas, Hamilton and Fort William, Ont. The accompanying illustrations were made in the plant at St. Thomas where the company operates what is virtually three foundries under the one roof. One shop is devoted exclusively to the manufacture of cast-iron, chilled wheels for large and small railroad cars. The second shop is divided into two parts. Miscellaneous castings, principally municipal work and pipe fittings are made in one part and brakeshoes are made in the other. The wheel shop is provided with two cupolas, one 60 and the other 56 inches inside diameter. Iron for the jobbing and brakeshoe shop also is melted in two cupolas each 54 inches inside diameter.

The present plant was erected in 1904, but car wheels were made in a preceding plant on the same site since 1891. It may be noted that the wheel floors are laid off in circular form with an individual power operated jib crane in the center of each floor. Wheel foundries designed and erected in recent years are operated on the straight line principle in which the chief advantage is the conservation of floor space and the utilization of air or electric current in a light type of traveling crane that spans each floor. In the original circular floor installation the jib crane in the center was operated by hand, but it was electrified many years ago and serves its purpose as rapidly and efficiently as many more elaborate installations.

Floor Layout Novel

The floor of the wheel shop is laid out in 10 circular floors, five on each side of a central gangway that extends from one end of the shop to the other. A battery of annealing pits is located between the third and fourth floors on each side. Each floor is served by an individual jib crane and an additional crane of the same type serves each of

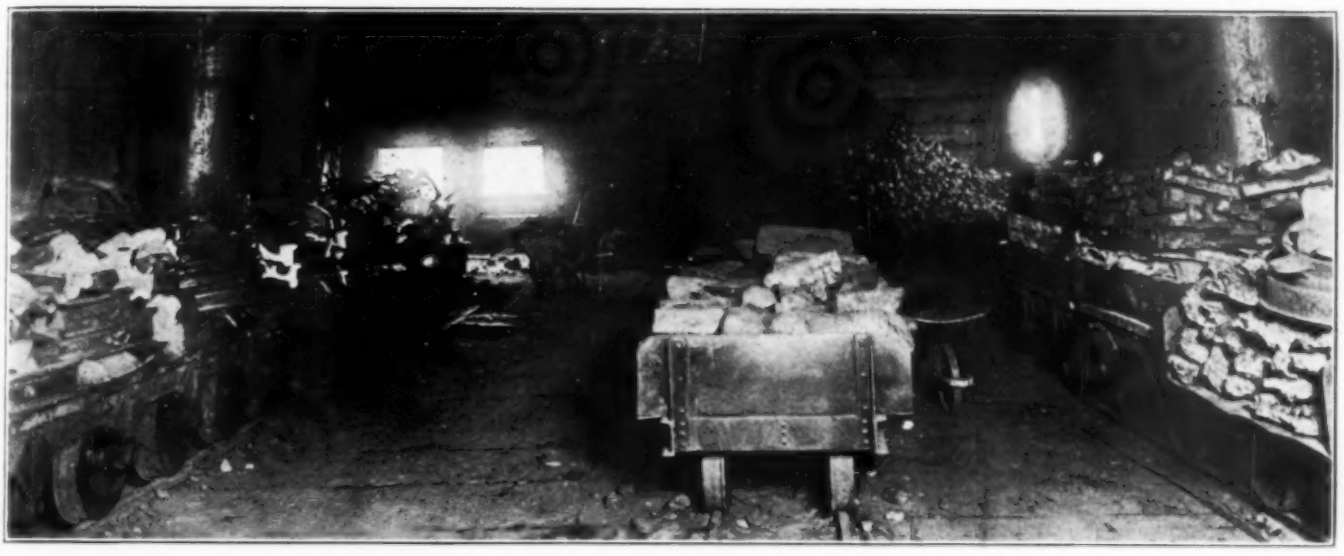


FIG. 4—ONE CHARGING FLOOR SERVES A BATTERY OF FOUR CUPOLAS—TWO ON THE LEFT MELT IRON FOR THE WHEELS—ONE ON THE RIGHT MELTS IRON FOR MISCELLANEOUS CASTINGS AND THE OTHER MELTS IRON EXCLUSIVELY FOR BRAKESHOES

the batteries of annealing pits. The cranes were designed and built by the company to meet its own peculiar requirements and present many points of interest. From the illustration Fig. 10, it will be noted that the crane is simple in design and operation, strong and rigid in construction, yet light enough to be manipulated easily. The frame is made of steel channels, with a pivot casting riveted to the top and another riveted to the bottom of the upright member, with the hoisting mechanism attached to the lower part of the same member and with a single sheave mounted at the extreme outer end of the jib. Power from the motor is transmitted through suitable gearing to a brake drum mounted on the same shaft as the drum to which the lower end of the hoisting cable is attached. The operator controls the movement of the load by a single lever, projecting at the back of the crane. By pressing the lever in one direction the friction wheel is brought into contact with the drum and the load is hoisted. When the lever is pressed in the opposite direction, the friction wheel is released and a brake is applied to the drum thus holding the load at any determined point.

When the lever is held in the central position both the brake and the friction

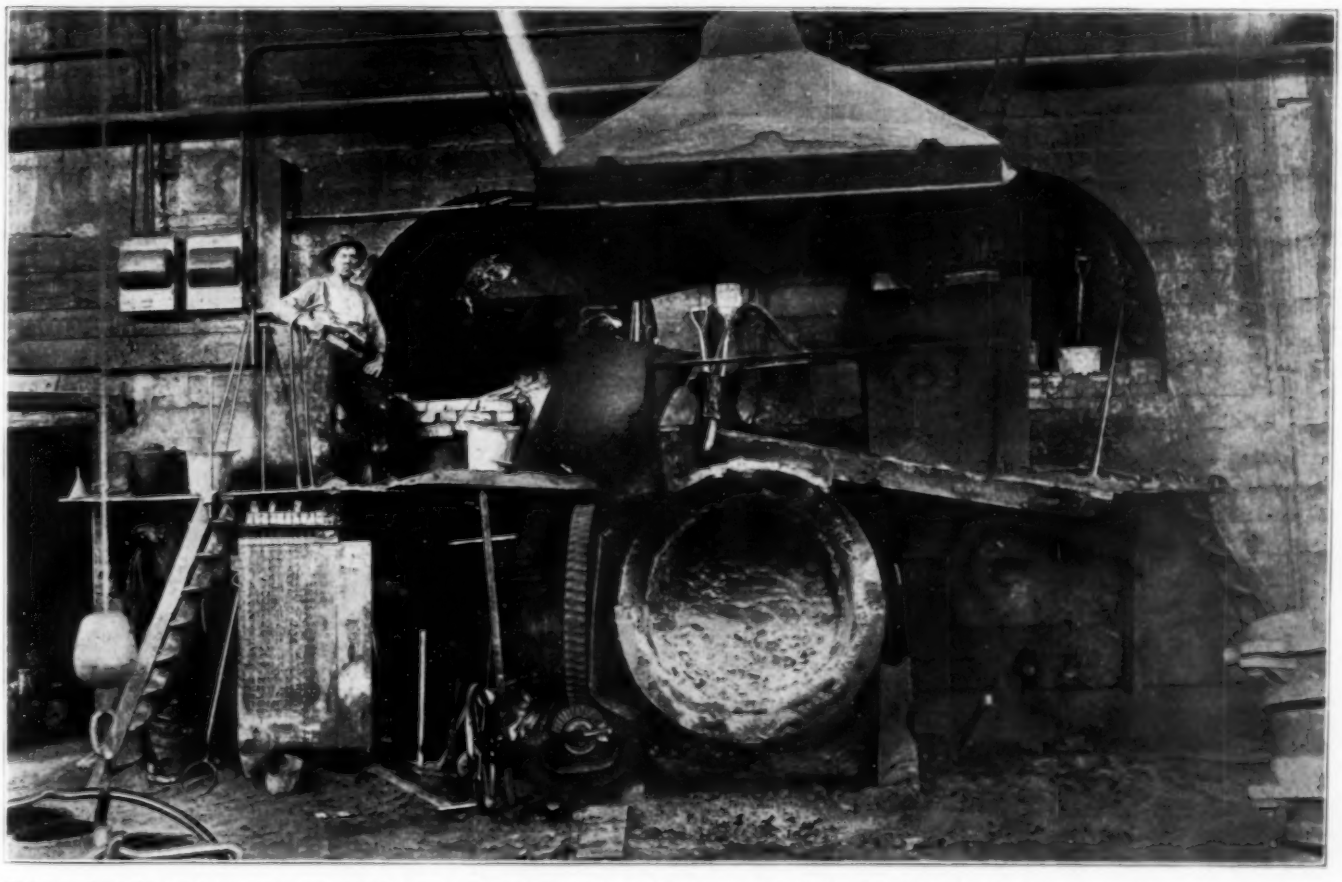


FIG. 5—SPOUTS FROM TWO CUPOLAS CONVERGE AND DISCHARGE IRON THROUGH ONE OUTLET INTO A 10-TON MIXING LADLE—IRON IS DISTRIBUTED TO THE VARIOUS FLOORS IN 1000-POUND LADLES SIMILAR TO THAT SHOWN IN FIG. 8

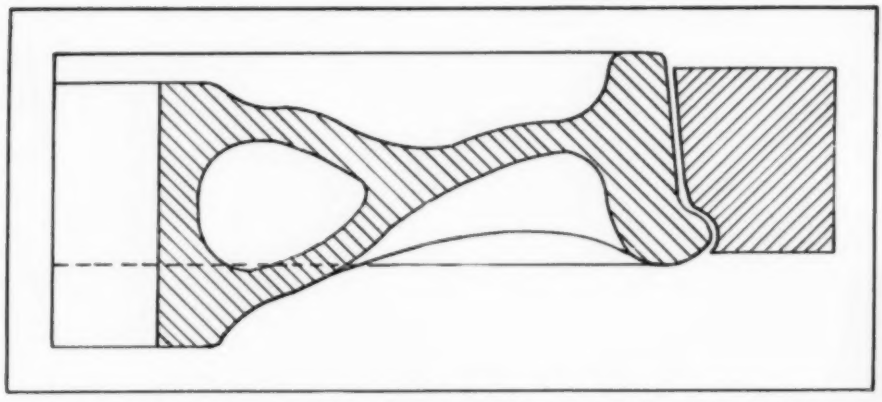


FIG. 6—CHILL ELIMINATES UNEVEN JOINT LINE ON THE FLANGE

wheel are released and the drum is free to revolve, thus lowering by gravity the load suspended from the end of the cable. The device is remarkably rapid and flexible in operation and particularly well adapted to the making of molds in which mechanical lifting plays such an important part.

The crane has a working radius of 17 feet and the center of the narrow circular track on which the molds are placed for pouring, is laid to the same radius. With this arrangement, the flasks always occupy the same relative position under the end of the jib and no adjusting is required to bring the cope and drag in line when opening or closing the molds. Two men, known as the molder and the helper—although one does almost as much actual molding as the other—put up from 22 to 25 car wheel molds a day, depending on the size.

In support of its claim that no suitable sand for molding car wheels is available in the district, the Canada Iron Foundries, Ltd., imports all its molding sand from Zanesville, O. This sand is shipped across the lake from Cleveland to Port Stanley and thence by rail to St. Thomas. The freight charges involved are offset to a certain extent by economies effected in the cleaning room where the castings require only a perfunctory rub with a wire brush. Practically all the adhering sand falls off before the casting arrives in the cleaning room.

Facing sand for the wheels is mixed in the proportion of 50 per cent new sand, 50 per cent old sand and with coal dust added in the proportion of 1 part coal dust to 6 parts sand. This prepared sand is riddled over the face of the pattern to the depth of 1 inch, then the remainder of the flask is rammed full of sand from the heap. Only the top face and the bottom face of the pattern are covered with sand. The tread of the wheel is formed in a heavy cast iron ring known as a chiller and which forms part of the cope. The chiller is machined accurately on the inside to the size of the desired wheel plus the contraction. It serves a double purpose. It chills the tread of the wheel, thus producing a wearing surface that outlasts any other material ever tried for the purpose. It produces a perfectly round wheel which is an important factor in helping the wheel maker to maintain a guarantee of at least five years continuous service.

The ridge left on the flange of the wheel between the chill and the drag causes the flange to spall after the wheel has been placed in service. To overcome

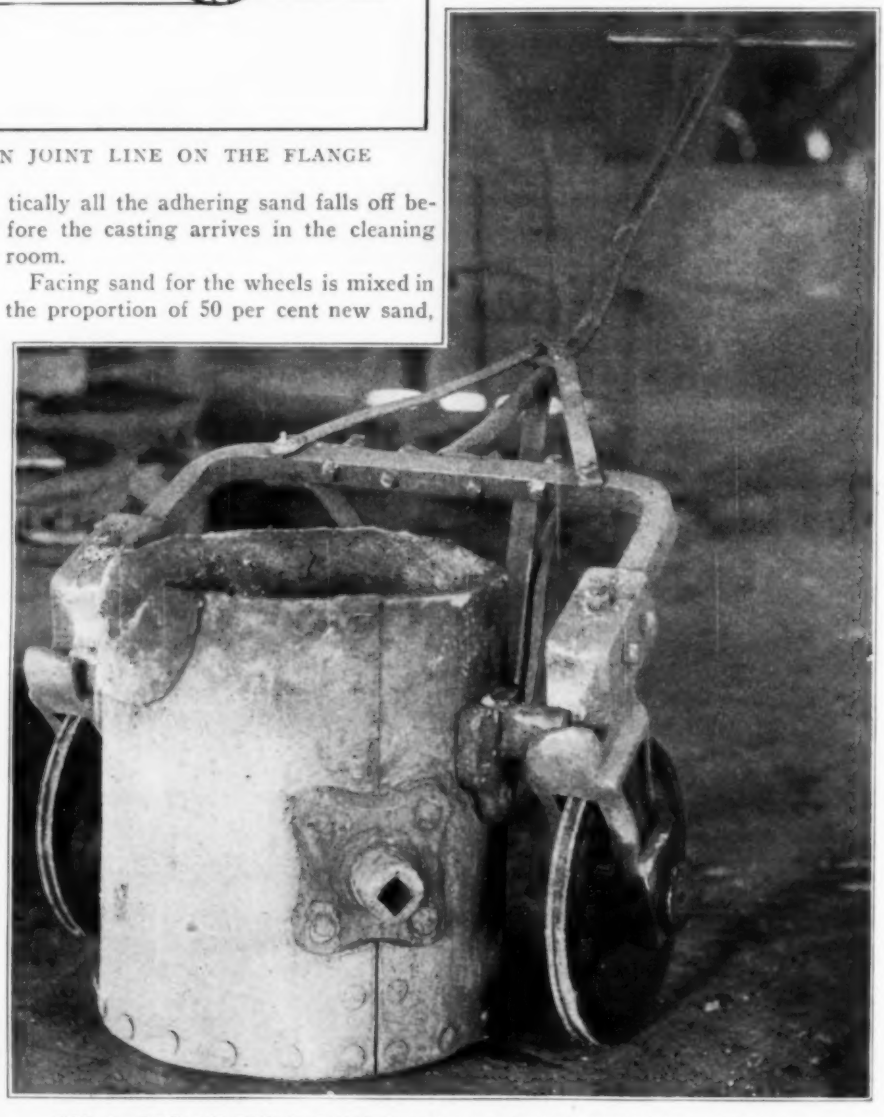


FIG. 8—ONE OF THE LADLES EMPLOYED FOR POURING THE WHEELS

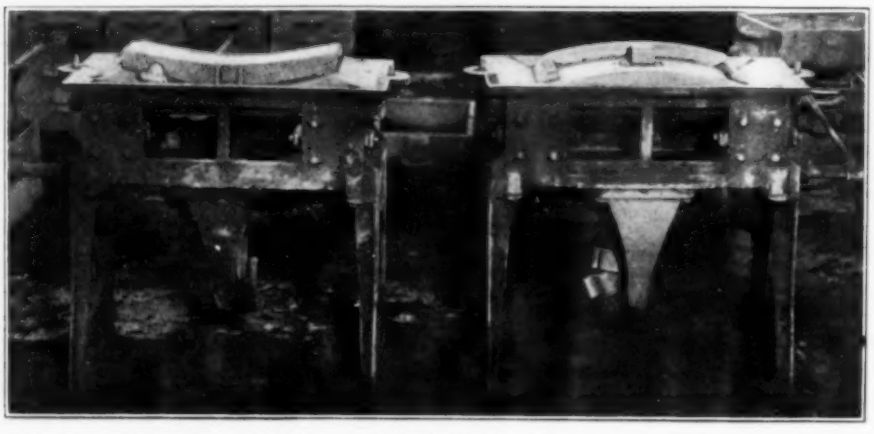


FIG. 7—BRAKESHOE MOLDS ARE RAMMED ON PLAIN STRIPPING PLATE MACHINES

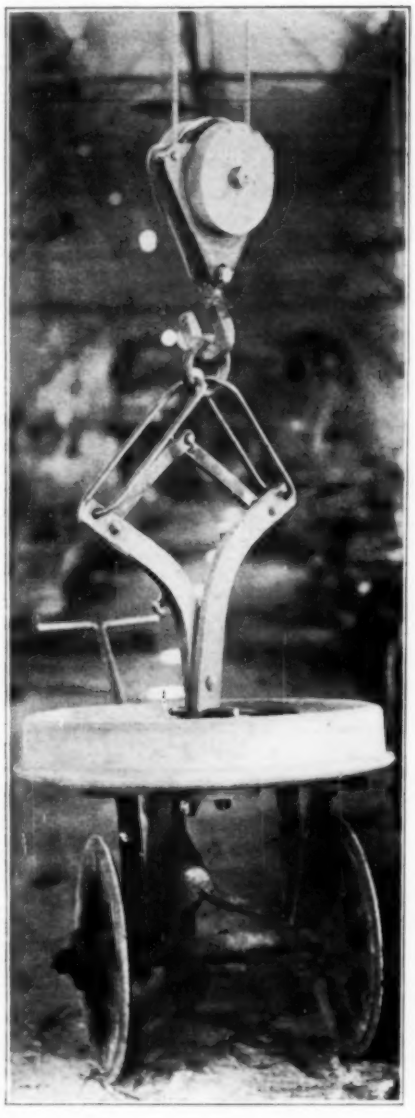


FIG. 9—AUTOMATIC TONGS LIFT THE HOT WHEELS FROM THE HAND TRUCK TO THE ANNEALING PITS

this tendency, C. S. Gilbert manager of the St. Thomas plant has designed a chill which embraces the flange of the wheel beyond the center line as shown at the right in Fig. 6. In this manner the flange of the wheel is as true, round and smooth as the remainder of the tread and will not spall from uneven contact with frogs and switches. The normal contraction on a 33-inch wheel is ⅜-inch or 3/16-inch away from the chill all around. This provides sufficient clearance to remove the rounded part of the flange from the chill. This style of chill still is in the experimental stage and has not yet replaced the regular or standard style of chill that has been used universally in car wheel foundries for many years.

After the castings are poured they are shaken out while still red hot and taken to the annealing pits where they remain four days. The style of hand truck and the special toggle hooks for handling the hot wheels are shown in Fig. 9.

Use Two Cupolas

Iron for the wheels is melted in two cupolas built by the Whiting Corp., Harvey, Ill. One is lined to 60 and the other to 56 inches inside diameter. Spouts from the two cupolas converge and unite in a common runner that discharges into a 10-ton mixing ladle. The general arrangement in front of the cupolas with the empty mixing ladle tilted forward, is shown in Fig. 5. The lining of the ladle is repaired slightly each day, claywashed and dried and usually remains in service constantly for approximately 6 months before it requires a general cleaning out. The cupolas are operated singly for about 7 hours continuously on alternate days and melt from 100 to 125 tons of iron.

Molten iron is taken from the mixer in a number of 1000-pound ladles similar to that shown in Fig. 8. The long central gangway is floored with iron plates which facilitate the use of a specially designed hand truck employed for conveying the ladles back and forth between the mixing ladle and the various wheel floors. The ladle is provided with two pairs of trunnions. One pair is set well above the center of gravity to prevent the ladle from tilting or upsetting in transit. This pair engages suitable sockets over the wheels in the hand truck. The other trunnions are engaged by a bail on the crane after the truck has deposited the ladle near one of the flasks and been removed. The second trunnions are attached near the center of gravity so that the operator may tip the ladle with a minimum of effort. The wheels of the truck are mounted in ball bearings and one man readily pushes the ladle to any desired place on the gangway.

With the exception of making the cores, two men do all the work connected with a floor of 25 wheels. They prepare their own sand, fill and ram the flasks, core the molds, pour them and shake them out. To the average foundryman the performance seems impossible, yet these men are through with the days work and go home between 2 and 4 o'clock depending on whether they are scheduled to receive first or last iron. The order is changed from day to day so that the men receive first iron in rotation. To an outsider the work appears to be of a laborious and exhausting character, but this first impression is somewhat modified when it is learned that the majority of the men have been constantly employed by the company over a period ranging from 5 to 30 years.

Four cupolas, two for the wheel shop and two for the miscellaneous jobbing and brakeshoe shop, are located between the two foundries and served from a

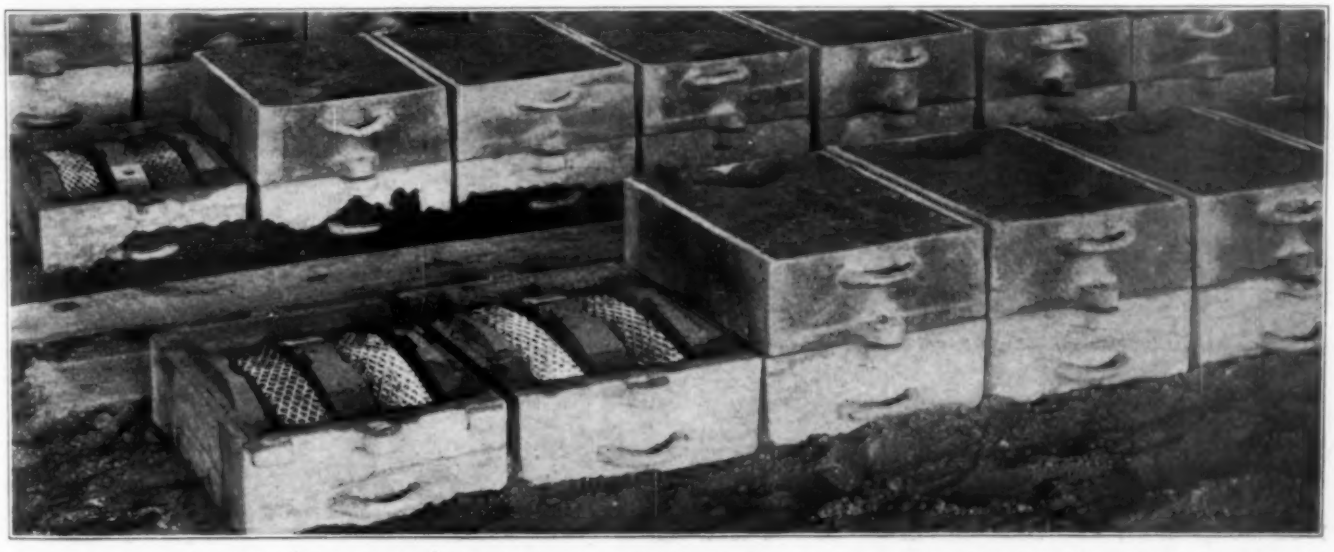


FIG. 10—BRAKESHOE MOLDS ARE LAID DOWN IN LONG FLOORS WITH A CAST IRON GANGWAY BETWEEN THE FIRST AND SECOND AND ANOTHER BETWEEN THE THIRD AND FOURTH ROWS

FIG 11—WHEEL MOLDS ARE ARRANGED FOR POURING IN A CIRCLE AROUND AN ELECTRICALLY OPERATED JIB CRANE

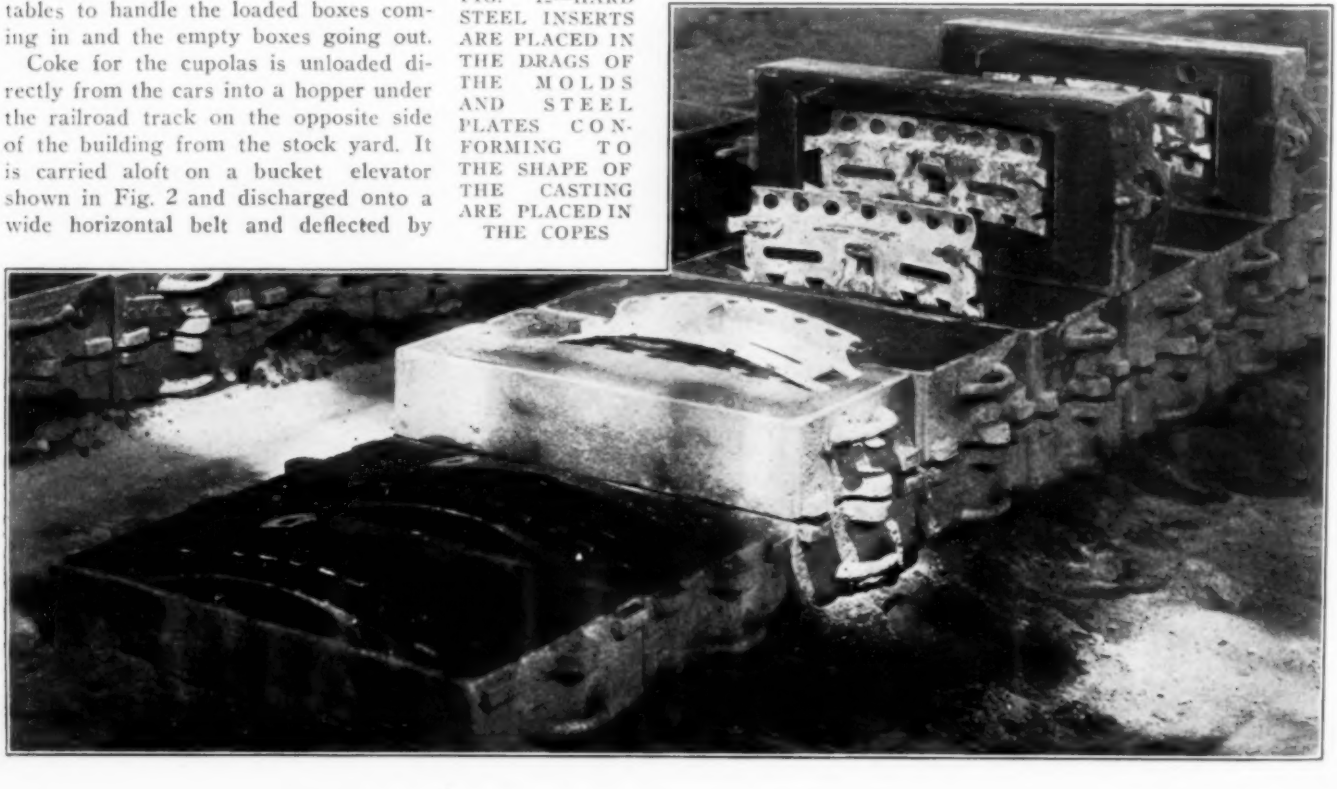
common charging platform as illustarted in Fig. 4. The materials for the iron charges are assembled, weighed and loaded on cars in the yard adjoining one side of the foundry building. The cars are pushed by hand on to two electrically operated elevators which discharge their loads at one end of the charging floor. The floor is equipped with three narrow gage tracks and three turntables to handle the loaded boxes coming in and the empty boxes going out.

Coke for the cupolas is unloaded directly from the cars into a hopper under the railroad track on the opposite side of the building from the stock yard. It is carried aloft on a bucket elevator shown in Fig. 2 and discharged onto a wide horizontal belt and deflected by suitable stops into a number of bins provided in the storage building shown in the upper left in the same illustration. The floor of this building is a continuation of the cupola charging floor. After the bins are filled, the surplus coke is discharged over the end of the belt and falls in a pile close to the cupolas as may be noted in the center of Fig. 4.

Iron charges for the wheel cupolas are made up of 3500 pounds of pig iron, old car wheels and steel scrap in varying proportions depending on the depth of chill and other characteristics required in the new wheels. A chill 1½ inches deep is specified on some of the larger wheels and from this the depth of chill

(*Concluded on Page 729*)

FIG. 12—HARD STEEL INSERTS ARE PLACED IN THE DRAGS OF THE MOLDS AND STEEL PLATES CONFORMING TO THE SHAPE OF THE CASTING ARE PLACED IN THE COPES



Tentatively Adopt Sand Tests

Committee on Molding Sand Research Includes Methods for Making Chemical Analysis in Report—All Tests Recently Published by American Foundrymen's Association—Makers of Testing Equipment Listed

WHILE a chemical analysis of molding sand is not necessary for the vast majority of sands now on the market, since most shipments are from well known sources of supply where thorough investigation has proved that no objectionable constituents are present, many molding sands are encountered which might test out favorably in bonding properties, permeability and fineness and yet be condemned after a chemical analysis. Results from a chemical analysis show the amount of fluxing materials present and the importance of these materials should not be overlooked when sands are purchased from sources not previously tried. The chemical analysis should be employed frequently on steel sands high in silica and intended for use as molding sands and core sands.

The following article on the chemical analysis of molding sand concludes the series which has been published in THE FOUNDRY covering the methods for testing molding sands which have been adopted tentatively by the joint committee on molding sand research. The boarding and cohesiveness test was published in the July 1, 1923, issue of THE FOUNDRY, page 545. The test for permeability was given in the Aug. 1, 1924, issue, page 635, while the test for fineness and dye absorption and the methods for sampling molding sands were published in the Sept. 1 issue, page 675. The tests and activities of the committee recently have been published in pamphlet form by the American Foundrymen's association and may be obtained from that society.

The development of testing methods has necessitated the designing of special equipment for conducting many of the operations outside the range of chemical analysis. To assist the foundrymen in securing suitable equipment for conducting the tests which previously have been described, a list of equipment and manufacturers has been prepared which may be obtained from the American Foundrymen's association.

Chemical Properties Are Determined

SAMPLES of molding sand, of which a chemical analysis is to be made, must be ground to pass through a 100-mesh sieve. The sample must be dry to the touch and be representative of the whole material under test. All determinations, except the determination of water at 105-110 degrees Cent., are made on the sample dried at that temperature. The sample is dried, cooled and weighed, the needed portion being transferred quickly, the bottle restoppered and weighed again. No further sample should be taken from an open weighing bottle until the contents have been redried. Distilled water should be used throughout and concentrated acids are to be used unless otherwise specified. All analyses must be corrected by blank runs on the reagents carried along with the analyses. For detailed information concerning the various analyses, the analyst should consult "The Analysis of Silicate and Carbonate Rocks" by W. F. Millebrand, United States geological survey bulletin 700; "The Chemical Analysis of Rocks" third edition, by H. S. Washington; and a "Treatise on Quantitative Inorganic Analysis," by J. W. Mellor.

To determine the water at 105-110 degrees Cent., a portion of the sample is air dried and 1 gram portions are weighed in a tared, wide, low-form, flat bottomed weighing bottle. The sample is heated uncovered for 1 hour in a ventilated drying oven at a temperature not below 105 nor above 110 degrees Cent. The stopper is lifted momentarily just before weighing, and the bottle restoppered and weighed. Using a similar weighing bottle as a counterpoise carried through all of the operations is a desirable procedure. The percentage loss is calculated and reported as H_2O at 105-110 degrees Cent. This determination is not necessary in the summation of results, but desirable for the study of different varieties of molding sands.

In the determination of the total volatile matter, 1 gram of the sample, which has been dried at a temperature of not below 105 and not over 110 degrees Cent., is transferred to a tared platinum crucible having a cover, is warmed gently under oxidizing conditions until the moisture has been expelled, and then at a dull redness until the carbonaceous matter has been destroyed, and finally with cover on and at approximately 1000 degrees Cent. to constant weight. The percentage of loss is calculated and reported as *loss on ignition*. This determination represents water not driven off at 105-110 degrees Cent., carbon dioxide and carbonaceous matter and is subject to any oxidation changes. The true water determination above 105-110 degrees Cent. would require heating in a closed tube with absorption and weighing of water.

To test for silica, two grams of the sample dried at 105-110 degrees Cent., are transferred to a platinum crucible, mixed intimantly with 10 grams of sodium carbonate, covered, and heated carefully until the evolution of carbon dioxide, occasioned by the reaction between the silica and carbonate, has ceased. The material then is heated until decomposed and the fusion is quiet. The crucible cover is cooled, placed in an evaporating dish, preferably of platinum to eliminate contamination, and, for the sake of celerity in evaporation, is treated with a little dilute hydrochloric acid, scrubbed clean and removed. The melt is covered with water and warmed gently. Melts usually may be so loosened from crucibles with even sides. The loosened melt is transferred to the evaporating dish containing the faintly acid solution used to clean the cover and care is taken to avoid mechanical loss through effervescence. The crucible is washed and any adhering matter removed by treating with dilute (1:1) hydrochloric acid and scrubbing. The evaporating dish then is covered and warmed until the melt has been decomposed, the solution being hastened by breaking up resistant lumps with the flattened end of a glass rod. When effervesence ceases, the glass cover is removed and washed and the contents of the dish evaporated to dryness, the crusts being broken from time to time with a platinum or glass stirring rod kept in the dish. When thoroughly

dry, the residue is cooled and drenched with hydrochloric acid and allowed to stand for a few minutes. An equal volume of hot water is added, the dish is covered and warmed on a water bath for 10 minutes. The residue is filtered on a paper of suitable size, washed thoroughly with hot dilute hydrochloric acid (5:95) and finally with hot water. The residue is reserved.

The filtrate is evaporated to dryness, thoroughly dehydrated as before, and again treated with acid and filtered. As little acid as possible is used and only a few minutes is allowed for the digestion of the residue in the acid. The solution is filtered through a second and smaller paper, washed with a little cold dilute hydrochloric acid (1:99), and finally with a little hot water. The small paper and the silica recovery should not require a great amount of washing. The filtrate and washings are reserved for the determination of iron and aluminum, as will be described later.

The two papers containing the silica recoveries are transferred, wet or dry, to a platinum crucible. The paper is charred carefully without allowing to inflame. The paper is ignited until the carbon is destroyed and finally with cover on, the silica recoveries are heated at 1200 degrees Cent. to constant weight. The impure silica is moistened with a few drops of dilute sulphuric acid, sufficient hydrofluoric acid is added to decompose the silica, and the mixture warmed slowly until all danger of effervescence is over. The mixture is evaporated to dryness, ignited carefully until the sulphates are decomposed and then heated at approximately 1000 degrees Cent. The mixture is cooled, weighed and this weight subtracted from the weight of the impure silica. The weight of any recovery obtained in the determination of iron and aluminum is added and the percentage of silica calculated.

Residue Is Fused

The nonvolatile residue from the silica determination is fused with as little sodium carbonate as possible in the determination of total iron, aluminum and titanium oxides. The cooled melt is dissolved in dilute hydrochloric acid and the solution added to the filtrate reserved from the silica determination. A few drops of nitric acid or bromine water are added and the solution boiled until all trace of chlorine or bromine is gone. Hydrochloric acid then is added, if not present already, in a sufficient quantity to insure a total volume of from 10 to 15 cubic centimeters of acid. A few drops of methyl red solution are added, the solution diluted to 200 to 250 cubic centimeters and then heated to boiling. The solution is neutralized by the careful addition of dilute ammonia (1:1), until the color of the liquid just changes to a distinct yellow. Toward the end of the neutralization a more dilute ammonia is used. The dilute solution is boiled for 1 minute, allowed to settle, filtered, and the precipitate immediately washed two or three times with hot 2 per cent ammonium chloride solution. The filtrate is reserved. The precipitate is dissolved on the paper in hot, dilute hydrochloric acid (1:1), the solution being caught in the original beaker and the paper washed thoroughly with hot water. The paper is reserved as it may contain some undissolved aluminum hydroxide. The solution is boiled, a little macerated filter paper added and the solution reprecipitated with ammonia as previously described. The precipitate is transferred as completely as possible to a new filter with hot 2 per cent ammonium chloride solution. Finally any adhering hydroxide is removed from the side of the beaker by scrubbing with the reserve paper, which is added and burned with the precipitate. The filtrate is added to the reserved filtrate and saved for the determination of calcium.

The precipitate is transferred to a weighed platinum crucible and heated gently until the danger of mechanical loss has passed, and at a higher temperature and under oxidizing conditions until carbon has been destroyed and finally for 10 minutes with the crucible covered over the blast lamp or its equivalent. The crucible is kept covered tightly, cooled and weighed, as $Al_2O_3+Fe_2O_3+TiO_2+SiO_2$. The residue is reserved for the recovery of silica and the determination of total ferric oxide and the percentage of combined oxides is calculated.

For the recovery of silica, 3 or 4 grams of potassium, or preferably sodium pyrosulphate are added to the combined oxides, the crucible covered snugly, and the solution heated until the salt is melted and in quiet fusion. The heating is continued at a dull red until the oxides are in solution. This fusion may be hurried and must be performed at the lowest temperature which will prevent the formation of a crust on the melt. The cooled melt is taken up with so much dilute sulphuric acid that there will not be less than 5 cubic centimeters of absolute acid and enough water to effect solution.

The solution is evaporated and eventually heated until sulphuric acid fumes come off copiously. After cooling, the solution is diluted to approximately 100 cubic centimeters, and stirred until the salts are dissolved. The tester must make sure that any small residue is silica and not unfused oxide, as shown by a light flocculent suspension as against a fine powder. The solution is filtered without delay, washed with hot water until free from soluble salts and the filtrate reserved. The residue is ignited, and weighed, corrected with hydrofluoric acid treatment. The weight of the silica recovered is added to that previously found and the gross weight of the combined oxides deducted. In case the nonvolatile residue is an appreciable amount, it must be recovered and added to the reserved filtrate by fusion with pyrosulphate and solution in sulphuric acid.

To determine the total ferric oxide, the hot reserved filtrate, preferably of 100 to 200 cubic centimeters volume and containing 5 per cent by volume of sulphuric acid, is passed through a Jones reductor using the customary precautions and the reduced solution quickly titrated with an approximately 0.03 normal potassium permanganate solution which has been standardized against the bureau of standards standard sodium oxalate. The titrate solution is reserved for the determination of titania, and after the permanganate required in the blank run is subtracted, the percentage of Fe_2O_3 is calculated. This value will be too high if titanium or vanadium is present. The latter need not be feared in this class of material and the effect of the former is overcome by subtracting the percentage of titania. The TiO_2 titre of a permanganate solution is the same as the Fe_2O_3 titre. If a determination of ferrous oxide is made, the percentage found must be calculated to Fe_2O_3 and subtracted from the previously determined value to get the percentage of ferric oxide in the sand. The determination of iron under the conditions previously discussed is not strictly accurate due to the instability of the reduced titanium solution. However, the error is slight if the amount of titania is small.

Determination of Titania

For the determination of titania, the tirated solution is evaporated to a volume of approximately 75 cubic centimeters, cooled and transferred to a 100 cubic centimeter Nessler comparison tube where 5 cubic centimeters of a 3 per cent solution of hydrogen peroxide are added and the solution diluted to 100 cubic centimeters. In another tube are mixed the same amount of fusion salt, iron as ferric sulphate, and acid as are in the unknown. This is diluted to approxi-

mately 95 cubic centimeters and a standard titanium sulphate solution added until the colors match. The percentage of TiO_2 is calculated and this value subtracted from the calculated percentage of FeO_3 previously obtained.

To determine the alumina in the sample, the following weights are subtracted from the weight of $Al_2O_3+Fe_2O_3+TiO_2+SiO_2$: (a) the weight of the silica recovered from it; (b) the calculated weight of Fe_2O_3 obtained; (c) the calculated weight of TiO_2. The remainder is regarded as Al_2O_3 and the percentage is calculated.

Two methods are given for the determination of lime, namely the gravimetric and volumetric methods. In the gravimetric method a few drops of ammonia are added to the combined filtrates from the ammonia precipitation and the solution is brought to the boiling point. Ten cubic centimeters of saturated solution of ammonium oxalate are added to the boiling solution and the boiling is continued until the precipitated calcium oxalate assumes a granular form. The mixture is allowed to settle for at least 1 hour and then is filtered and washed with boiling water, no more water than necessary being used, due to the solubility of the oxalate. The filtrate and washing are reserved for the determination of magnesium. With the small amounts of calcium, magnesium and aluminum involved, it hardly is necessary to dissolve the precipitate and to attempt to recover the latter two. The lime precipitate is ignited in a weighed platinum crucible with a cover. The crucible is uncovered at first until the carbon is destroyed and then is covered well until a constant weight is reached. The percentage of CaO then is calculated.

Volumetric Method

By the volumetric method the paper and precipitate are transferred, as in the gravimetric method, to the well washed beaker in which the precipitation was made. The paper is spread out against the upper portion of the beaker. The precipitates are washed from the paper with a jet of hot water, the paper folded and left adhering to the upper portion of the beaker. Fifty cubic centimeters of dilute sulphuric acid (1:10) are added to the contents of the beaker, the contents diluted to a volume of 250 cubic centimeters with hot water, and heated to a temperature of from 80 to 90 degrees Cent. A standard of approximately 0.03 normal permanganate solution is titrated until the pink end point is obtained. The folded filter paper, which has been adhering to the sides of the beaker, is dropped into the liquid, which is stirred, and the titration again is continued until the pink color is obtained. A Gooch crucible may be used instead of filter paper. The percentage of CaO is calculated from the total quantity of standard permanganate solution used.

In the test for determining the magnesia, the filtrate from the calcium precipitate is acidified with hydrochloric acid and is concentrated on the water bath to about 200 cubic centimeters. Ten centimeters of a saturated solution of microcosmic salt are added and then ammonia is added by the drop until a crystalline precipitate begins to form or the solution is alkaline. Finally 10 cubic centimeters in excess are added and the solution is allowed to stand at room temperature for from 12 to 48 hours. The solution is filtered, the beaker rinsed with a little 5 per cent by volume ammonia, the precipitate is washed slightly and the filtrate discarded.

Precipitate Is Dissolved

The precipate adhering to the beaker is dissolved on the paper in hot dilute hydrochloric acid and diluted to 100 cubic centimeters. One cubic centimeter of a saturated solution of microcosmic salt is added and ammonia is added by the drop as before and finally in 5 to 10 cubic centimeters excess. The solution is allowed to stand for from 6 to 24 hours, then is filtered on paper and washed with dilute 5 per cent by volume ammonia. The wet or dry precipitate is heated carefully, preferably in a muffle, until the paper chars without flaming. The carbon is destroyed under oxidizing conditions and at the lowest possible temperature, and the precipitate finally is ignited at approximately 1000 degrees Cent. to constant weight. The percentage of MgO is calculated from the weight of $Mg_2P_2O_7$ obtained.

The carbon dioxide is determined on a 10-gram sample, dried at 105 Cent. according to the method given in the United States geological survey bulletin No. 700, pages 217-8.

In brief the method is as follows: The weighed sample is boiled with dilute hydrochloric acid in a small Erlenmeyer flask attached to an upwardly inclined condenser. After passing through the drying system the carbon dioxide is caught by weighed adsorption tubes filled with soda lime or with ascarite and calcium chloride. The drying system should employ successively calcium chloride, anhydrous copper sulphate and calcium chloride again. The function of the anhydrous copper sulphate is to retain hydrogen sulphide from decomposable sulphides and any hydrochloric acid that may pass over. Arrangement is made for a current of air, free from carbon dioxide, with which to sweep out the apparatus before and after the determination and for slow current during its continuance. The percentage of carbon dioxide then is calculated.

To determine the potassium and sodium oxides, a little more than 1 gram of sand is ground in a small agate mortar with 0.5 gram of ammonium chloride. The material is mixed thoroughly by grinding with the pestle. About 5 grams of calcium carbonate are weighed out and a small portion is used as will be described. Sufficient carbonate is transferred to form a thin layer on the bottom of an unweighed, deep form, platinum crucible. About 3 grams of the carbonate are mixed with the sand and ammonium chloride and the motor and pestle are scrubbed with the remaining carbonate. This is poured on the mix as a cover.

The crucible is covered snugly and heated over a low flame for 10 minutes or until no more vapors are given off. The heating is continued with only the lower one-third of the crucible heated to a dull red for 45 minutes and then is allowed to cool. It is best to set the crucible on an asbestos shield.

The sinter in the crucible is covered with water when cool and allowed to slack. The contents then are transferred to a platinum dish, diluted to 50 centimeters, the mass rubbed up with an agate pestle, the pestle rinsed off and the solution boiled for 5 minutes. The solution is decanted through a 9 centimeter filter into a 600 cubic centimeter beaker. The rubbing and extraction treatment is repeated at least three times.

Treated with Ammonia

The filtrate is treated with a little ammonia, brought to the boiling point, about 2 grams of ammonium carbonate dissolved in 25 cubic centimeters of water added and the boiling continued for a minute or two. The bulky precipitate is allowed to settle and is filtered into a 500 cubic centimeter dish of porcelain or platinum. The residue is washed with hot water and the filtrate evaporated to dryness over a water bath.

The basin, covered with glass, is placed on a square of gauze over a low flame, heated carefully until all danger of decrepitation is passed, the cover removed and the heating continued until all ammonium salts are expelled. The basin should be heated at as low a temperature as possible to avoid loss of alkali chlorides by volatilization. The dish is cooled, enough

water added to dissolve the chlorides and a drop of barium chloride solution, or more if appreciable amounts of sulphates are indicated, are added and finally a few drops of ammonium carbonate solution are added to precipitate the excess of barium and the last traces of lime. The tester must make sure that all soluable salts are in solution and the mixture again evaporated to dryness. It then is treated with 5 cubic centimeters of water and filtered through a 5.5 centimeter filter placed in a 3.5 centimeter funnel into a previously weighed 35 cubic centimeter crucible with a cover. The paper and residue are washed with 3 to 4 cubic centimeter portions of hot water. One drop of hydrochoric acid is added to the filtrate and the solution evaporated to complete dryness in the water bath. When dry the filtrate is covered, placed on a triangle and cautiously heated until all danger of decrepitation is past. When vapors of ammonium chloride rise, the cover is raised gently until all fumes are driven off. Finally the cover is raised and the cover and crucible are heated gently until free from ammonium chloride. The cover should be heated below red heat and the crucible heated so that the chlorides suffer no more than incipient fusion.

Are Cooled and Weighed

The crucible and contents in a desiccator are cooled and weighed as NaCl+KCl. The mixed chlorides are tested for purity by dissolving in 5 to 10 cubic centimeters of water. If the solution is clear, the procedure is as described in the following discussion. If the solution is turbid, it is filtered and washed as before and again evaporated to dryness and weighed.

To determine the potassium oxide, the solution of mixed chlorides is treated with sufficient chloroplatinic acid to combine with sodium and potassium. If the solution of chloroplatinic acid contains 0.05 grams of platinum per cubic centimeter, it may be assumed that the proper results may be assured by adding as many cubic centimeters as 34 times the weight of the chlorides. The solution is placed on the water bath, evaporated until syrupy, cooled and the crucible half filled with alcohol of 0.86 specific gravity. The solution is allowed to stand and is stirred gently until the sodium salt has dissolved and the residue is a golden yellow. The solution is filtered through a weighed Gooch crucible, washed with the 80 per cent alcohol, dried at 130 degrees Cent. and weighed as K_2PtCl_6. The weight obtained in the blank is subtracted, the correct weight multiplied by 0.1938 to get the weight of K_2O, and the percentage of K_2O determined.

Sodium oxide is determined by multiplying the weight of K_2PtCl_6 by 0.307 to reduce it to KCl, subtracting the weight of mixed chlorides and multiplying the weight of sodium chloride found by 0.5308 to reduce it to Na_2O. This weight is corrected as indicated by the blank and the percentage of Na_2O is calculated.

The determination of ferrous oxide is attended by several difficulties. Satisfactory results are impossible in the presence of carbonaceous matter. If the material is coarse and passes into solution with difficulty, grinding must be done with the greatest of care to avoid oxidization. The following method is applicable in the absence of organic matter and does not require special apparatus.

A small portion of the sand is tested by boiling gently for 20 minutes with hydrofluoric acid in a covered platinum crucible. If the above test shows that the sample leaves but little residue, 0.5 to 1 gram of the sample is taken, dried at 105 degrees Cent. and placed directly in a platinum crucible of 80 to 100 cubic centimeters capacity. In case the sample is not decomposed easily, the weighed portion is transferred to an agate mortar and ground under absolute alcohol long enough to yield a powder that will leave little or no residue in solution. The alcohol is allowed to evaporate spontaneously, and when the last trace has disappeared, the powder is transferred to the platinum crucible and the mortar and pestle rinsed with a jet of hot water.

In either procedure, the powder is covered with a little air free water, 10 cubic centimeters of dilute sulphuric acid (1:3) added carefully and the cover placed on in case effervescence is noted. Air free hot water is added until the crucible is half full and the covered crucible is placed on a triangle well down over a lamp turned low and protected from drafts. The air in the crucible is displaced rapidly by a stream of carbon dioxide directed beneath the lid raised on one side. Before the liquid is allowed to boil, the gas current is discontinued and the crucible covered with a well fitting lid. The material is allowed to boil gently, the lid is drawn a little to one side and 10 cubic centimeters of hydrofluoric acid added. The lid then is replaced, the temperature raised cautiously until steam comes off and the temperature then is lowered until there is a steady ebullition without danger of loss. Steam should issue continuously for 20 minutes or as many minutes as may be deemed necessary or allowable. The covered crucible is transferred to the titration vessel, which may be of glass and contains a cold saturated solution of boric acid in freshly boiled water with an excess of the solid acid and 5 cubic centimeters of sulphuric acid, and which already is under the burette. The solution is titrated rapidly with a standard approximately 0.03 normal permanganate solution until a first pink blush appears throughout the liquid.

If unattacked residue shows after titrating, it is allowed to settle completely. The top of the liquid is decanted off, is washed once by decantation and transferred to an agate mortar by the aid of a jet of water. The solution is allowed to settle, the most of the water is decanted off and what remains is ground under water and washed into the large crucible. This treatment is repeated with hydrofluoric and sulphuric acids as before and in smaller amounts and for a shorter time. It then is titrated and the operation repeated if necessary for a third time. The percentage of FeO is calculated from the total amount of permanganate required.

Cupola Bridges During Long Heat

Question: We have a 90-inch cupola lined to 54 inches in which we run a continuous heat from 7 a.m. until 5 p.m. and melt 110 tons of iron that is poured into radiator castings. On account of operating conditions on the molding floor we have to shut off the blast occasionally. The blast enters the cupola through six, 7 x 12-inch tuyeres. Melting conditions are satisfactory until noon. Then a bridge starts to form above the tuyeres and continues growing until the bottom is dropped. We will appreciate your suggestion on how to keep the cupola clean during the second half of the heat.

Answer: From your statement that the cupola melts satisfactorily for the first 5 hours of the heat it is apparent that your operating conditions are all that could be desired. From the further statement that you melt 110 tons of iron daily in a 54-inch cupola we do not think your cupola bridges to any abnormal extent. Assuming that the blast is off in the aggregate for 1 hour daily, the cupola is melting for 9 hours, or at the rate of a little better than 12 tons per hour. The normal melting speed of a 54-inch cupola is approximately 12 tons per hour so that really we do not see that you have any serious ground for complaint. Every cupola bridges to some extent above the melting zone, but so long as the slight bridging does not affect the speed of melting it is not

considered a factor of any importance. The only cupolas that run freely without any tendency toward bridging are those operated in connection with bessemer converters, or those operated continuously for other purposes and designed on similar lines to a bessemer plant cupola. The tuyeres are located about twice the usual height above the sand bed and limestone is used more extensively than in ordinary practice. The slag hole is located comparatively low.

What Constitutes Good Foundry Coke

BY H. W. ANDERSON

WHENEVER trouble occurs in making gray iron castings the foundryman blames it on the coke. In the majority of cases one finds other causes such as rustry scrap, burnt iron and poor slagging as the principal reason for foundry troubles.

One foundry using a certain kind of coke will obtain excellent results while a foundry across the street cannot use it and obtain good results. This condition should not exist as coke giving satisfactory results in one shop will give the same results in another provided the melting conditions are similar. If the melting results are not satisfactory it is time to look into the cupola operation.

The ideal foundry coke is hard, having a fine structure, little ash and sulphur, such a coke is difficult to obtain. Table I shows the variations in good, fair and bad coke.

For general foundry work the following specifications will protect the buyer:

	Less Than Per Cent
Moisture	3.00
Volatile Matter	1.15
Ash	10.00
Sulphur	0.85

Shatter test above 65 per cent

The shatter test is important as it tells how much fine coke to expect due to handling. A high test coke will run 70 on this test and will give about 2 per cent of fine coke which cannot be used. Foundrymen should guard against a low shatter coke as it will crush in the cupola and the yard will have an accumulation of coke breeze. A coke carrying a high moisture content causes the purchaser to pay freight on several tons of water and the coke producer charges for this water at the current price of coke. Table No. II will make this clear, taking coke No. 1 at $5.00 per ton with freight rate of $1.00 and No. 2 at $4.50 with same freight rate, using a thirty ton car in each case.

The difference between these cokes amounts apparently to $17.42 on thirty tons of 58 cents per ton. When you consider the cost of unloading and handling and charging this 7000 pounds of material and that it requires an additional amount of slag to dispose of it, then the costs mount up.

The following table base the price of coke on the carbon content and allows for the handling of excess material, and takes 90 per cent carbon coke as the standard:

Carbon Content Per Cent	Unit Value	Market Value of Coke at 5 dollars
90	100	$5.00
88	94	4.70
85	80	4.00
82	62	3.10
80	50	2.50
75	33	1.65
70	None	0.00

The recent improvement in the manufacture of by-product coke through the selection of low ash coals now gives this material an attractive future in the foundry field. Some of this coke is now being produced with an ash content of 6 per cent and there is no valid reason why the ash should exceed 10 per cent. When one considers the enormous qualities of tar, ammonia and benzol wasted annually through the operation of the bee-hive ovens it is imperative that some steps be taken to curtail this waste, There is no doubt that the time is not far distant when the conservation of this material will receive mort attention.

In the course of this investigation a number of defective castings have been inspected. In the majority of cases the coke had been blamed. The inspection revealed that in only 5 per cent of these cases had the iron and coke been at fault. It was noted that 85 per cent of the defects were due to careless molding such as incorrect gating, poor ramming, misruns, runouts, core shifts etc. The 5 per cent due to the iron was located in the pig iron used. This particular car was badly oxidized and on breaking the pigs we found every one to be unsound and full of blow-holes. This kind of iron will cause a foundry more grief than ten apprentice molders. The whole day's work is likely to be ruined, and the only way of using this iron is at the rate of one pig to the charge. Whenever any oxidized pig iron shows up get in touch with the furnace people and reject the car.

Table II

Losses Sustained by Excessive Moisture

No. 1 at $5.00 per ton with freight rate of $1.00 per ton

Analysis		Weight pounds	Freight	Invoiced as coke
Moisture	1.10	660	$0.33	$1.65
Volatile	0.90	540	0.27	1.35
Ash	7.60	4,660	2.33	11.65
Carbon	90.40	....	....	....
Sulphur	0.70	....	....	....
Total		5,860	2.93	14.65

Freight and inert material total, $17.58

No. 2 at $4.50 per ton with freight rate of $1.00 per ton

Moisture	4.90	2,490	$1.47	6.62
Volatile	1.20	720	0.36	1.62
Ash	15.00	9,000	4.50	20.25
Carbon	78.90	....	....	....
Sulphur	1.00	....	....	....
Total		12,660	6.33	28.49

Freight and inert material, $34.82

Table I

Comparative Analyses of Different Cokes

	Beehive Oven Coke			By-product coke		
	Good	Fair	Bad	Good	Fair	Bad
Moisture	1.10	2.80	4.90	2.00	3.00	4.00
Volatile	0.90	1.10	1.30	0.90	1.10	1.20
Ash	7.60	10.70	15.00	7.00	12.00	17.00
Carbon	90.40	85.40	78.80	90.10	84.90	77.80
Sulphur	0.70	0.80	1.15	0.70	0.85	1.10

The author is official chemist and chairman, committee on research, Southern Metal Trades association with headquarters at Chattanooga, Tenn.

Keeping Pace with Auto Output

PERHAPS at some future date when the supply of automobiles will have reached the saturation point, when the manufacturing facilities will be equal to the demand for new cars, and for replacement of those consigned to the scrap heap, perhaps by that time the various foundries engaged in the production of castings employed in automobile construction will have succeeded in standardizing their plants and methods to such an extent that a description of one will serve for a description of all. However, until that time arrives, and it seems no nearer now than it did at any time during the past five years when professional business prognosticators and others with no particular qualifications, business or otherwise, sounded the usual note of alarm and presented imposing arrays of figures to justify their opinion that the auomobile manufacuring business had passed its peak, until that time arrives each foundry is bound to show points of individuality. The automobile business is so young comparatively and its growth to its present astonishing proportions has been so rapid and spectacular that inevitably the number of outstanding men, pioneers along the line of quantity production on highly intricate castings, is confined to a small circle.

The type of man with sufficient courage to break away from traditional foundry practice and belief and with faith sufficient to attempt the mass manufacture of castings that have to conform to such close and rigid specifications, that type of man never is satisfied. His restless energy together with the fact that the demand for castings has increased constantly over a period of several years has resulted in shop conditions, practices and buildings that almost constantly are in a state of transition. The foregoing applies in such marked degree to the plant of the Wilson Foundry & Machine Co., Pontiac, Mich., that a description in any given year since its inception would have to be revised the following year.

A descriptive paper on the operation of the plant was presented by D. R. Wilson, vice president and general man-

FIG. 1—A SECTION OF THE MONORAIL IN FRONT OF THE MIXING LADLE IS SUSPENDED INDEPENDENTLY OF THE REMAINDER SO THAT THE WEIGHT OF IRON IN THE BULL LADLE MAY BE INDICATED ON A SCALE MOUNTED ON A COLUMN IN THE VICINITY AND IN FULL VIEW OF THE LADLE TENDER

ager, before a meeting of the National Founders association and later was reproduced in sections in three successive issues of THE FOUNDRY, March 15, April 1 and April 15, 1923. Extensive changes have been made since that time, particularly in installation of new equipment and additions to the group of buildings. The method of molding many of the castings also has been changed. The cylinder and transmission case molds now are placed on conveyers in the immediate vicinity of the molding machines and are poured and shaken out as fast as they are assembled. Formerly, the molds were set up in long rows on the floor. The new arrangement has released a large area of available floor space, which it is anticipated will be utilized in taking care of orders beyond the past capacity of the plant.

Record of Growth

A brief resume of the principal changes that have taken place in the plant during the past 10 years will serve to indicate the rapidity of its growth. It also in a measure will convey some impression of the personality of the men, Charles B. Wilson and David R. Wilson, president and vice president respectively, who have been continuously in active charge of the plant and who have expanded it to its present position as one of the largest foundry plants in the world devoted exclusively to the production of castings for automobile engines. Before the recent lull in business, the daily melt had risen to 360 tons. Recent changes involving increased floor space and a new charging deck behind the battery of cupolas have invested the foundry with a potential daily capacity of 500 tons.

FIG. 2—A CHAMBER UNDER THE FLOOR IN EACH OVEN PROVIDES A CIRCULATION OF HEATED AIR ENTIRELY AROUND THE CORE RACKS

The business was started in 1914 when Wilson Bros. purchased the old Flanders foundry and machine shop. The foundry building measured 70 x 125 feet with a core room adjoining 70 x 90 feet. The nucleus of an organization including A. Weber, the present foundry superintendent, was brought from Cleveland where the members had received a training in the foundry of the Ferro Machine & Foundry Co., under the supervision of the veteran John Stoney. In contrast to the heavy tonnage attained in a comparatively few years, it is interesting to note that the initial heat taken off by this band of pioneers weighed 1700 pounds.

Plant Steadily Enlarged

By the close of 1914 the available floor space was found to be inadequate and early in 1915 the foundry building was enlarged by the addition of an extension 100 x 200 feet. A sand storage building 70 x 100 feet was erected at the same time. In the following year, 1916, the capacity of the plant was more than doubled by the erection of a building 100 x 500 feet adjoining the existing building. At the same time a cupola building and accessories 50 x 150 feet was erected at one end of the combined old and new building and three cupolas 96-inch shell made by the Whiting Corp., Harvey, Ill., were installed to take care of the molds made on the greatly increased floor area. Formerly, all the iron required was melted in the 60-inch cupola located near the center and at one side of the original old foundry building. Part of the present core room 120 x 240 was erected and equipped dur-

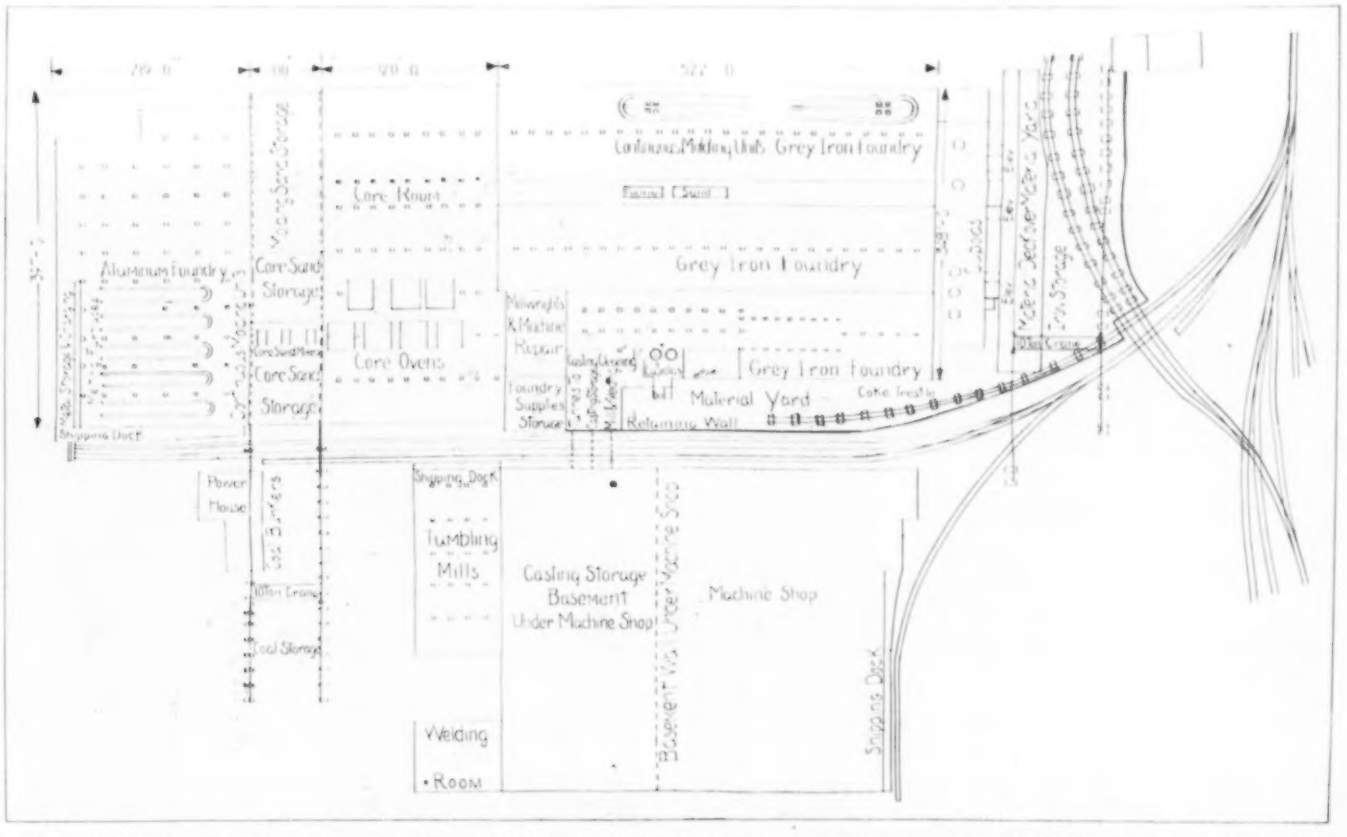


FIG. 3—GENERAL LAYOUT OF THE PLANT SHOWING THE MANNER IN WHICH IT HAS EXPANDED IN 10 YEARS ALSO SHOWING THE LOCATION OF THE LATEST ADDITIONS, THE ALUMINUM CASTING FOUNDRY, THE MOLD CONVEYORS AND THE EXTENSION TO THE CHARGING DECK

FIG. 4—ODD LENGTHS OF WIRE ARE CUT TO STANDARD LENGTHS IN A REVOLVING TURRET HEAD THAT REVOLVES AGAINST A SHEAR

ing early months of the same year.

In 1919, the main building was extended by an addition equal to that added in 1916. Also a space 30 feet wide between the existing building and the addition was roofed in the entire distance from one end of the building to the other. This 30-foot space between the two parts of the building was required to furnish an air and light space between the longitudinal walls of the inverted *A* roof by which each of the buildings is surmounted. The cupola building was extended an additional 90 feet and two more 96-inch cupolas, also supplied by the Whiting Corp., were installed. In practice only three cupolas are employed daily. The remaining three are undergoing repairs preparatory to going into service on the following day. An extension to the core room, 120 x 240 feet, was added in 1919 to correspond with the increase in the available molding floor area. In this year the sand storage shed, 80 x 200 feet, erected in 1916 also was extended an additional 200 feet. At present it measures 80 x 400 feet and has a capacity of 750 carloads of sand. This is equivalent to approximately a 10 months supply when the foundry is operating approximately to capacity and consuming 1000 tons of new molding sand and 2700 tons of core sand per month.

A new aluminum casting foundry was erected and equipped last year adjoining the sand storage building, but to avoid confusion further reference will be omitted in this description. For the same reason no reference will be made to the extensive machine shop operated as part of the plant. The present article is solely concerned with the foundry and with the methods, materials and operations involved in the preparation of castings up to and including the point where they are shipped from the cleaning department.

By consulting the plan shown in Fig. 3 it may be noted that the sand and cores enter one end of the building housing the molding floors. The stock yard and melting units are located at the opposite end. The flow of materials is toward the center and the resulting product, the castings, are discharged through one side of the building near the center. They are trucked to the mouth of a tunnel and loaded on a conveyer which carries them under the railroad tracks and discharges them in a cleaning room that forms the basement of part of the machine shop.

Four Main Divisions

Omitting t[he] aluminum foundr[y] taking the ot[her] various units in [the order] the first to r[e]ive attention, [which] logically from a foundry standpoint and from its position on the plan as shown in the illustration, is the sand storage department. This building, of reinforced concrete with a wood roof, is separated into four main divisions by walls that extend from the floor upward to the bottom of the crane runway. The end of the building near the railroad is pr[o]vided with a transverse opening at a corresponding height through which a 10-ton crane made by the Whiting Corp., transfers the sand in a grab bucket from the railroad cars to the sand bins. On the opposite side of the tracks, the crane travels on an open-air runway and unloads all the coal to be burned under the boilers in the powerhouse.

A space between two core sand bins is equipped with three sand mixers made by the Standard Sand & Machine Co., Cleveland. Some of the original mechanism has been removed and other features have been modified. The bucket elevator for loading the mixer has been discarded. Each mixer now is equipped with a double hopper situated immediately above the pan. The hopper is kept filled with two grades of sand by the grab bucket suspended from the crane. A measuring box with a known cubic content is located under each half of the hopper and the covering slide over each box is operated by a small pneumatic cylinder. The amount of sand for a batch of any desired mixture is indicated as so many boxes. The element of guess work is taken out of the process by this arrangement. The operator pulls a lever a definite number of times. At each pull a measured boxful of sand is discharged into the mixing pan. An automatic gage draws a measured amount of oil from a tank. The oil then is sprayed over the sand by a compressed air jet. Where water is required in the mixture it is sprayed over the sand from a suitable supply pipe. Careful experiments have been conducted to determine the proper amount of time the sand should be allowed to revolve in the mixer. A clock is provided for the benefit of the operator and the mixtures are checked frequently by men who are competent

FIG. 5—DRIED CORES ARE ASSEMBLED, TESTED AND GAGED ON CONVEYORS LOCATED BETWEEN THE OVENS AND THE FINAL STORAGE RACKS

Cut to this point ——————————→

TYPICAL ANALYSES OF MISCELLANEOUS COMMODITIES USED IN FOUNDRY PRACTICE

By J. M. Quinn

Commodity	Name Symbol	Silica SiO_2	Ferrous Oxide FeO	Ferric Oxide Fe_2O_3	Alumina Al_2O_3	Calcium Oxide CaO	Magnesium Oxide MgO	Sulphur S	Loss	Water H_2O	Alkali	Phosphorus P	Source of Data	Year
REFRACTORIES—(Continued)														**REFRACTORIES (Continued)**
Fluxes—														
Lime—Burnt—Dried		0.58	.....	0.29	0.29	91.79	0.56	.....	6.39	.....	.....	.....	Illinois Steel Co., Gary, Ind.	1913
Lime—Burnt—Dried		0.70	.....	0.29	0.29	72.28	0.56	.....	28.87	.....	.....	.....	Illinois Steel Co., Gary, Ind.	1913
Lime—Burnt—Lump		1.24	.....	Trace	Trace	86.06	0.62	.....	11.24	.....	.....	.....	Stuart & Green, *The Iron Age*, September 15	1921
Lime—Burnt—Granular		0.82	.....	0.10	0.24	93.00	0.73	0.080	.....	.....	.....	.....	U.S. High Speed Steel & Tool Corp., Green Island, N. Y.	1920
Lime—Stone		4.70	.....	0.65	1.15	45.56	5.12	.....	.....	.....	.....	.....	Anniston Steel Co., Anniston, Ala.	1916
Lime—Stone—Fairmont—Natural		1.71	.....	0.97	0.61	53.39	0.53	0.074	.....	0.93	.....	0.024	Illinois Steel Co., Gary, Ind.	1913
Lime—Stone—Bedford—Natural		0.50	.....	0.30	0.15	54.90	0.55	0.030	.....	.....	.....	0.006	Illinois Steel Co., Chicago	1910
Sand—Silica		97.80	.....	0.38	0.82	0.12	0.08	.....	.....	.....	.....	.....	Clyde Iron Wks., Scotland	1915
Sand—Silica		97.25	.....	0.06	0.10	0.08	0.39	.....	0.36	0.24	0	.....	Bureau of Mines, Bulletin 77, Washington D. C.	1916
		Calcium Fluoride CaF_2	Silica SiO_2		Iron Oxide + Alumina $Fe_2O_3+Al_2O_3$	Calcium Carbonate $CaCO_3$								
Spar—Fluor—Natural		89.97	3.86	.....	.....	2.39	.....	.....	.....	.....	.....	.....	Illinois Steel Co., Gary, Ind.	1913
Spar—Fluor—Natural		83.15	5.00	.....	1.35	6.15	.....	.....	.....	.....	.....	.....	Illinois Steel Co., Chicago	1910
Spar—Fluor—Natural		95.00	0.50	.....	1.00	0.75	.....	.....	.....	.....	.....	.....	Illinois Steel Co., Chicago	1910
		Carbon C	Silicon Si	FeO	Iron Oxide + Alumina $FeO+Al_2O_3$	Calcium Oxide CaO	Magnesium Oxide MgO							
Lining Materials—														
Carborundum—Crude Crystals		34.00	63.50	.....	2.40	0.10	.....	.....	.....	.....	.....	.....	Pring, The Electric Furnace	1921
Carborundum—Purified		27.90	65.40	.....	5.10	0.30	0.20	.....	.....	.....	.....	.....	Pring, The Electric Furnace	1921
		Silica	Manganese	Iron Oxide + Alumina		Calcium Oxide	Magnesium Oxide	Sulphur	Ignition Loss	Water H_2O	Alkali	Volatile Matter		
		SiO_2	Mn	Fe_2O_3	Al_2O_3	CaO	MgO	S						
Dolomite—Burnt—Dried		2.95	.....	0.65	1.90	53.10	37.73	.....	3.77	.....	.....	.....	Illinois Steel Co., Gary, Ind.	1914
Dolomite—Raw Stone—Natural		2.61	.....	0.57	0.53	29.46	20.68	0.033	.....	0.82	.....	.....	Illinois Steel Co., Gary, Ind.	1914
Dolomite—Raw Stone—Natural		0.50	.....	0.23	0.60	30.55	21.15	0.030	.....	.....	.....	.....	Dolen & Shepard Product Illinois Steel Co., Chicago	1909
Prepared Dolomite—Dolite		2.20	.....	0.86		57.37	38.16	.....	0.85	.....	.....	.....	Haws Refractories Co., Johnstown, Pa.	1920
Prepared Dolomite—Kendymag		8.22	.....	5.02	2.01	51.02	32.45	.....	1.20	.....	.....	.....	Kennedy Refractories Co., Pittsburgh	1920
Prepared Dolomite—Magdolite		6.72	.....	6.96	2.04	51.51	32.05	.....	.....	.....	.....	0.41	Inter-State Iron & Steel Co., Chicago	1919
Prepared Dolomite—Magdolite		5.77	.....	6.12		51.05	35.05	.....	0.82	.....	.....	.....	Haws Refractories Co., Pittsburgh	1920
Prepared Dolomite—Magdebrent		1.84	0.20	8.17		56.86	31.26	.....	0.51	.....	.....	.....	Haws Refractories Co., Pittsburgh	1920
Prepared Dolomite—Magnite		1.35	.....	1.52		59.70	37.77	.....	0.50	.....	.....	.....	Haws Refractories Co., Pittsburgh	1920
Prepared Dolomite—Syndolag		4.66	0.98	6.81		52.80	31.78	.....	0.51	.....	.....	.....	Haws Refractories Co., Pittsburgh	1920
Prepared Dolomite—Syndolag		2.48	.....	6.28	2.66	51.50	34.91	.....	.....	.....	.....	2.71	Inter-State Iron & Steel Co., Chicago	1919
Ganister—Crushed Rock		98.43	.....	0.57	0.60	0.10	Trace	.....	.....	0.29	.....	.....	E. R. Baldridge & Co., Hollidayburg, Pa.	1920
Ganister—Crushed Rock		96.36	.....	0.20	2.08	Trace	Trace	.....	1.26	.....	.....	.....	National Sales & Trading Co., Philadelphia	1920
Ganister—Crushed Rock		97.50	.....	0.36	1.25	Trace	Trace	.....	.....	.....	.....	.....	Taggart & Co., Philadelphia	1920
Ganister—Crushed Rock		87.06	.....	0.69	11.24	Trace	Trace	.....	.....	.....	.....	.....	Clyde Iron Wks., Scotland	1915
Ganister—Crushed Rock		88.56	.....	0.97	10.16	Trace	Trace	.....	.....	.....	.....	.....	Sheffield, England	1915
Ganister—Finely Ground		96.00	.....	Trace	2.50	Trace	Trace	.....	.....	.....	.....	.....	Albany, Sand & Supply Co., Albany	1920

Do not cut—Fold along this line for binding

Note—This sheet may be cut along this line and one half folded over on the other to bind in a 5 x 7 inch note book.

Cut to this point ——————————→

THE FOUNDRY DATA SHEET, SEPT. 15, 1924
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

TELEPHONE RANDOLPH 3804

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CHICAGO

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ROSIVIEW STA. ILL., (ILL. CENT. R. R.)
POST OFFICE
ROSICLARE, ILL.

February 8
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The Foundry,
Mr. J. D. Pease,
Director Advertising Sales,
Penton Building
Cleveland, Ohio.

Dear Sir,-

A year ago we introduced the use of Hillside Washed Gravel Fluor Spar to gray iron foundrymen.

We have found that our full page advertising in THE FOUNDRY has brought us very definite results and can attribute many orders to the interest which this advertising has created. Some of the largest foundries are among those using Fluor Spar daily and we look for a constantly increasing demand from a large number of satisfied customers.

Yours truly,

HILLSIDE FLUOR SPAR MINES

Jay L. Hench

Jay L. Hench
Vice-President and
Manager of Sales

JLH:L

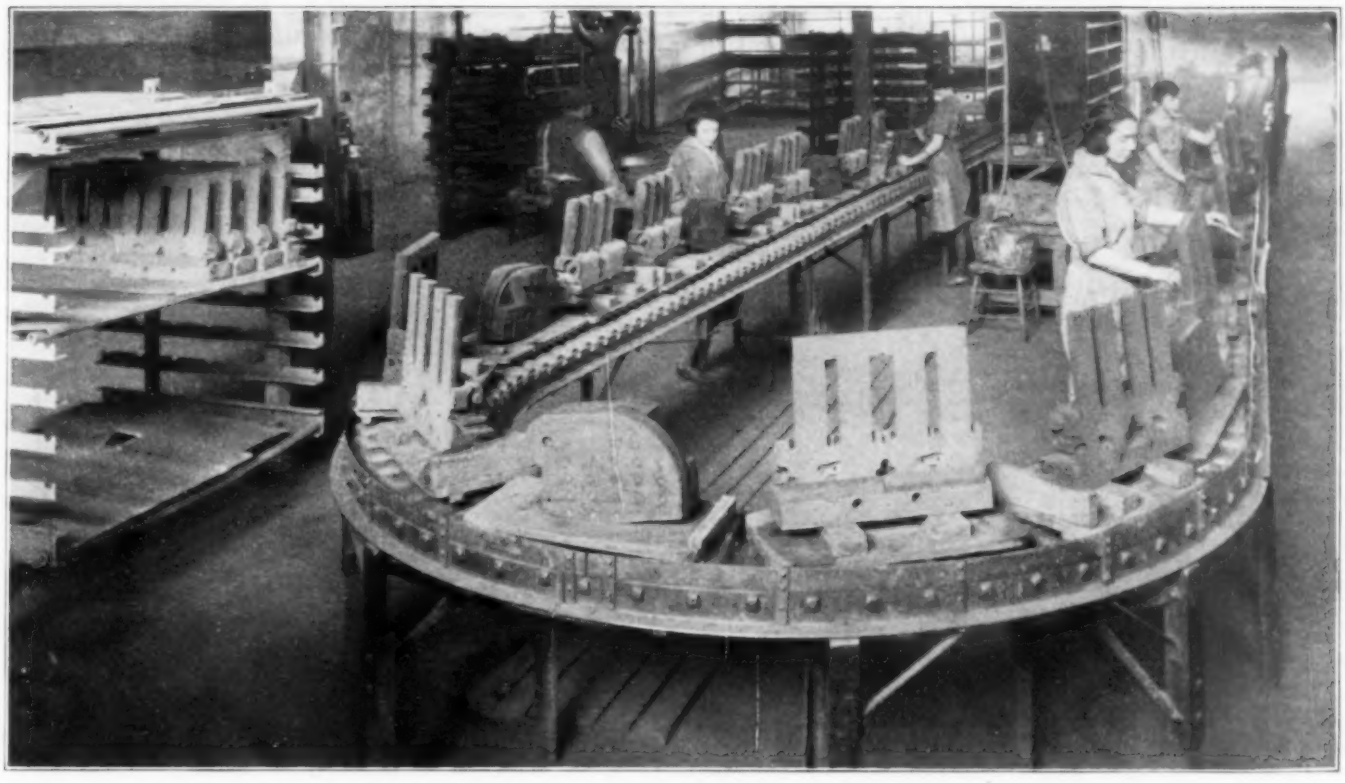


FIG. 6—CRANKCASE CORES ARE TAKEN FROM THE RACKS, SURFACED ON THE JOINT AND THEN PLACED ON A CONVEYOR WHICH CARRIES THEM PAST OPERATORS, EACH WITH A SPECIFIC DUTY TO PERFORM—WHEN THE CORES ARE REMOVED FROM THE FAR END OF THE CONVEYOR THEY ARE READY TO GO INTO THE MOLDS

to detect any variation from the standard required; after each batch is mixed, it is removed to the coreroom in a small two-wheel hand-propelled truck. The mixer is mounted on two high concrete piers which afford ample room for the entry of the truck below the discharge gate. New sand for the cores is procured from Port Huron, Mich., and Michigan City, Mich. The molding sand comes from Ohio.

The extent to which cores are employed in automobile engine castings may be gaged by the item in a former statement to the effect that the monthly consumption of core sand is 2700 tons. This is almost three times the amount of new molding sand used in the same time. In this connection also, it may be interesting to state that 10,000 gallons of linseed oil are consumed monthly as binder in the core department. Fuel oil for various purposes is burned at the rate of 26,000 gallons per month and coke for

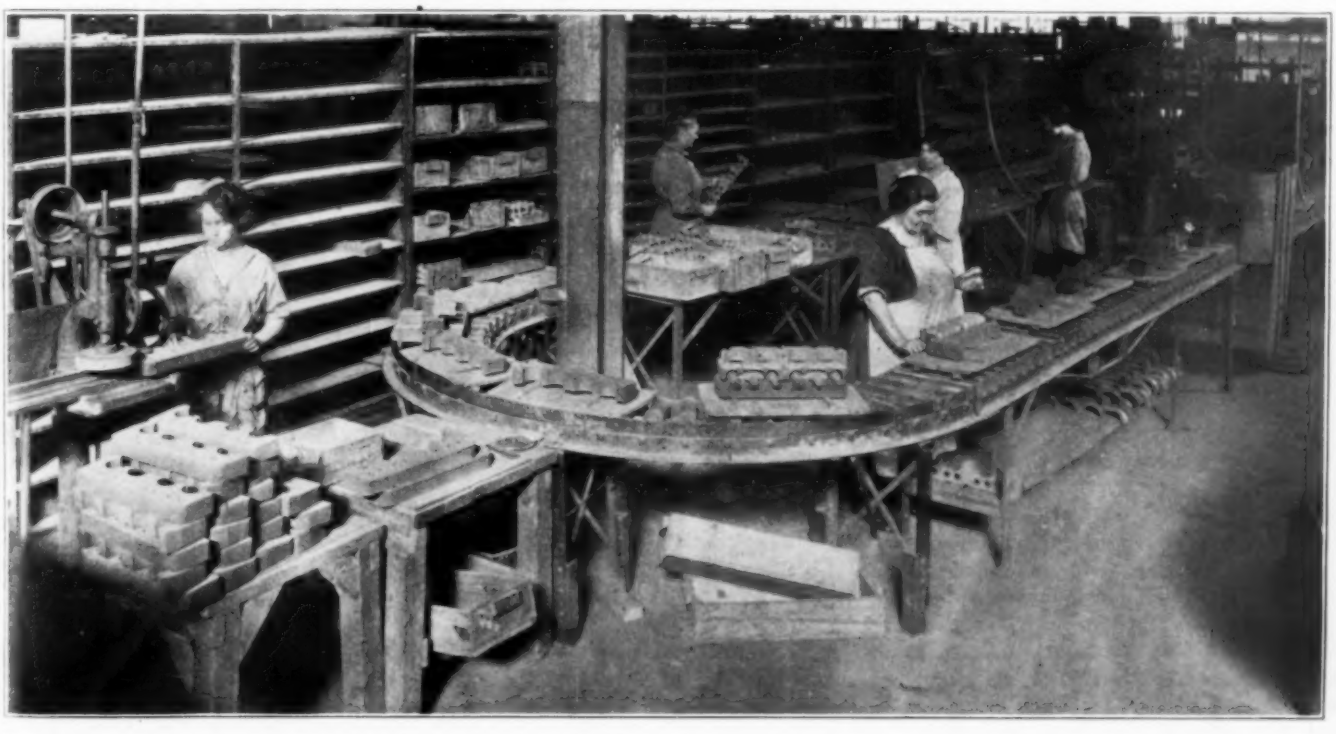


FIG. 7—SPECIAL GRINDING DEVICES ARE PROVIDED TO INSURE A TRUE SURFACE AND ACCURATE DIMENSIONS ON THE CORES—THE WATER JACKET, INTAKE AND EXHAUST CORES ARE ASSEMBLED ON THIS CONVEYOR

the cupolas amounts to 1200 tons. Both the core oil and fuel oil are stored in steel tanks inside the building close to the wall adjoining the railroad tracks. The core-oil tanks have a capacity of 25,000 gallons and the fuel oil tanks have a capacity of 30,000 gallons. They are loaded by gravity from tank cars on the railroad siding and the liquid afterward is pumped under pressure to the various distributing stations.

Extensive Coreroom

The coreroom, 120 x 400 feet, occupies the entire space between the sand storage building and the three sections of the main building devoted to making and pouring the molds. It is readily apparent that this is an advantageous arrangement and reduces to a minimum the distance to which sand and cores must be trucked before they are used.

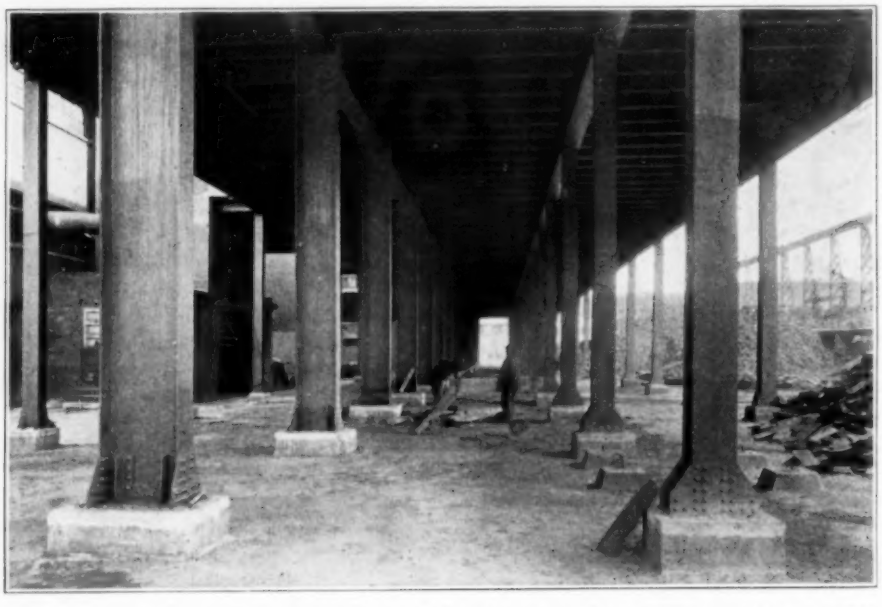


FIG. 8—THE ELEVATED MATERIAL STORAGE PLATFORM IS SUPPORTED ON HEAVY STEEL COLUMNS RESTING ON SUBSTANTIAL CONCRETE FOUNDATIONS

Light is exceptionally well distributed over this department through a glass-covered, sawtooth roof. A system of ventilation adopted on the ovens takes care of practically all the smoke and fumes generated and adds to the comfort of the employes, male and female, who work in the vicinity. The management has secured the services of a desirable class of women and girls in its core room and has taken pains to surround them with a favorable atmosphere and provide attractive working conditions. They are segregated from the male employes. They are under female supervision and have their own entrance to the coreroom. A rest room, wash and locker room in charge of a competent matron is provided for their comfort and convenience, they are paid good wages. Reference to the foregoing, if it serves no other purpose, illustrates perhaps in a startling manner the extent to which coremaking methods and conditions have changed in recent years.

Ovens for drying the cores, as shown in Fig. 3, are grouped in seven batteries, 10 ovens to each battery arranged back to back in sets of five. The ovens were built by Holcroft & Co., Detroit. Each battery is a self-contained unit, heated from a single firing chamber located below the floor. Flues from the firing chamber convey the heat to each oven through suitable openings at the floor level. By referring to Fig. 2, it will be noted that the steel plates on which the core rack is designed to rest, do not form the floor of the oven. A space 2 feet deep and the full size of the oven is provided under the plates. It is claimed this chamber assists in producing a uniform temperature at all points around the core rack. The claim is based on the theory that if a cold strata of air exists it will be on the bottom and by placing the bottom of the chamber so far below the bottom of the rack, the cold strata of air will be removed to a point where its effects will not be felt.

Mild forced draft is supplied each battery of ovens by a fan which discharges air into the tunnel in front of the firing chamber. The only opening from the tunnel to the outer air is through a manhole in the floor. When this manhole is closed the air delivered by the fan is slightly compressed and in that condition passes through the fire and thence into the various ovens comprising the battery. A suction fan mounted at a suitable point on top of each battery serves to draw the steam out of the ovens while the cores still are filled with moisture. Each oven is fitted with individual dampers over the inlet and outlet flues and through these the temperature of the ovens is regulated. Pyrometers are installed in each battery to assist the oven tender in maintaining any desired temperature. Every factor in connection with the production of satisfactory cores has been determined carefully by experiment and it has been found that the temperature at which the cores are baked exercises an important bearing on the size of the scrap pile.

Many of the larger cores are made on rollover machines supplied by the Grimes Molding Machine Co., Detroit, but a considerable percentage of the total number of cores are made in hand manipulated metal coreboxes on a large number of benches. Each bench is designed for the use of a single coremaker and everything is done to enable him or her to work to the greatest advantage. The benches are arranged in rows with their backs facing an aisle down which the sand is brought by attendants and shoveled through openings in the back of the benches. The various materials required by the coremaker, including sand, plates, dryers, wires and rods, are brought to the bench and the cores are removed as rapidly as the coremaker turns them out of the box. Each employe has a well defined set of duties, but the duties of one are made to synchronize with those of others and the result is an organization that functions as a unit.

Brick floors are laid in every department of the plant except the coreroom. The coreroom floor is surfaced smoothly with concrete to facilitate the operation of the electric lift trucks employed to convey the green cores to the various ovens and later to convey the dried cores to the storage racks and assembly stations. Cores that must conform to such close measurements must be handled carefully to prevent any vibration that might cause distortion. Metal forms or as they usually are termed, dryers, are employed extensively on a great variety of cores for the same reason. The dryer supports the core while it is green and prevents it from sagging during the drying process.

Wires Are Salvaged

Wires for the cores are cut and bent in one section of the coreroom equipped with machinery and special appliances designed for the purpose. The exact number and shape of the wires best suited to each core has been determined and the wires are furnished each coremaker on that basis. Bins in the vicinity of the machines are kept stocked with wires cut from new stock and with other wires salvaged from the cleaning room. The wires from the cleaning room are returned with the fins and

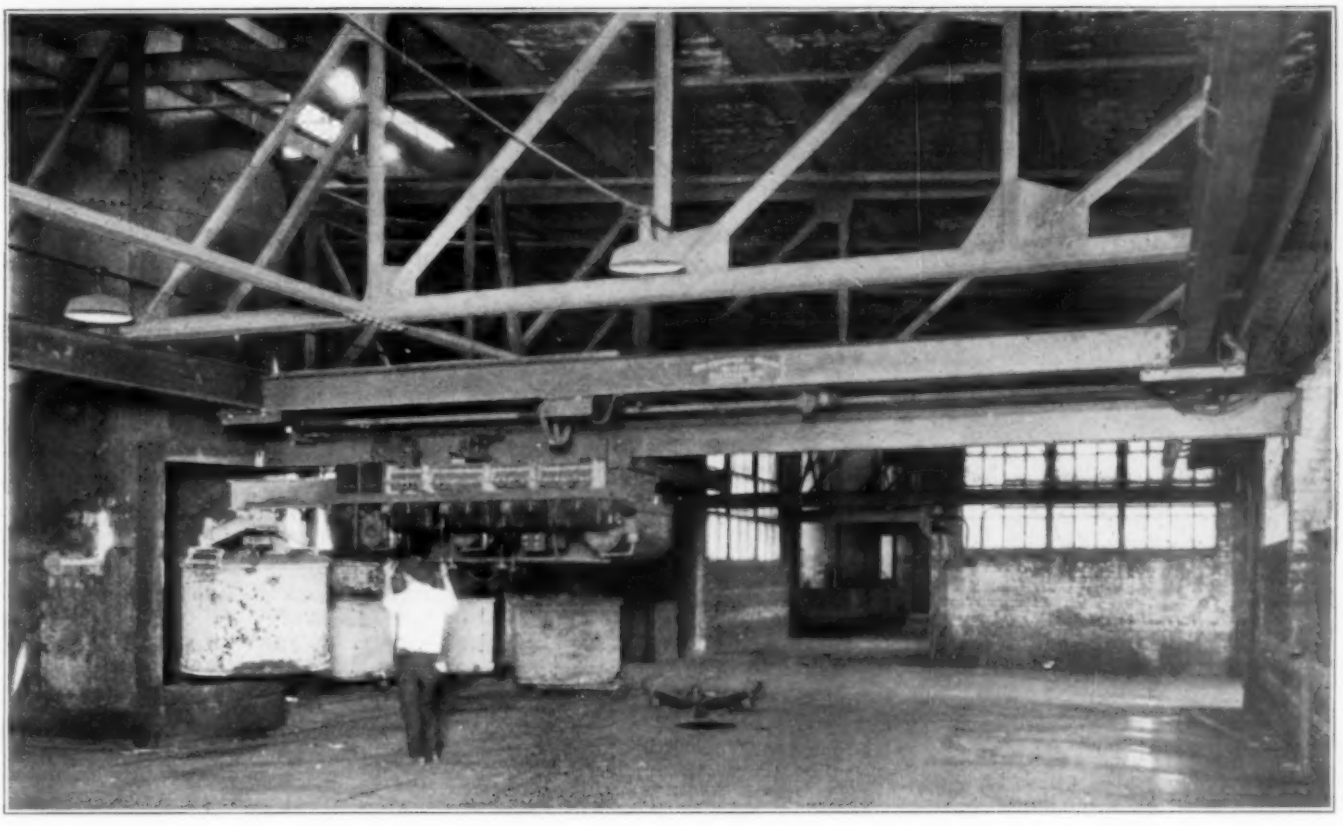


FIG. 9—MATERIAL FOR EACH CHARGE IS LOADED INTO A CIRCULAR STEEL CONTAINER MOUNTED ON A LOW 3-WHEEL TRUCK—THE CONTAINER IS PICKED UP ON THE END OF A RAM AND PLACED IN THE CUPOLA WHERE THE BOTTOM OF THE CONTAINER IS RELEASED—A CONE SHAPED BOTTOM DISTRIBUTES THE CHARGE UNIFORMLY

other pieces of small scrap and are picked out by hand. The cast iron scrap is gathered into boxes, melted in a small cupola and poured into pigs. These pigs later are used to form part of the charge in the regular cupolas used for melting the iron for the castings.

At one time the miscellaneous small scrap was sold to junk dealers for a trifle. It is estimated that a saving of approximately $10 a ton has been effected by remelting the scrap in the company's own cupola.

Machines supplied by the Baird Machine Co., Bridgeport, Conn., B. F. Shuster Co., New Haven, Conn., and the Worthington Pump & Machinery Corp., New York, are employed in straightening the wires, cutting them to length and in many cases bending them to the required shape. A special

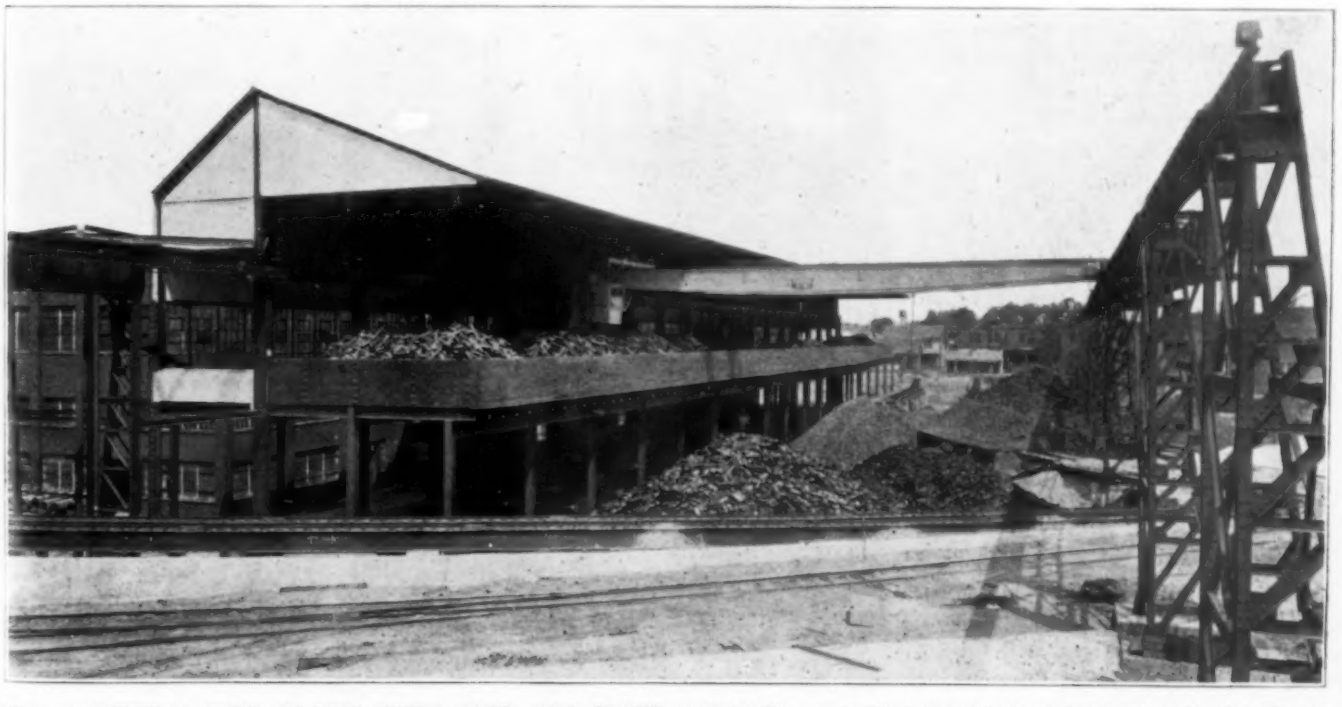


FIG. 10—GENERAL VIEW OF THE STOCK YARD—THE CRANE WHICH HAS AN EXCEPTIONALLY WIDE SPAN IS PROVIDED WITH A DOUBLE MAGNET WHICH ENABLES IT TO HANDLE PIG STEEL AND SCRAP AT A RAPID RATE

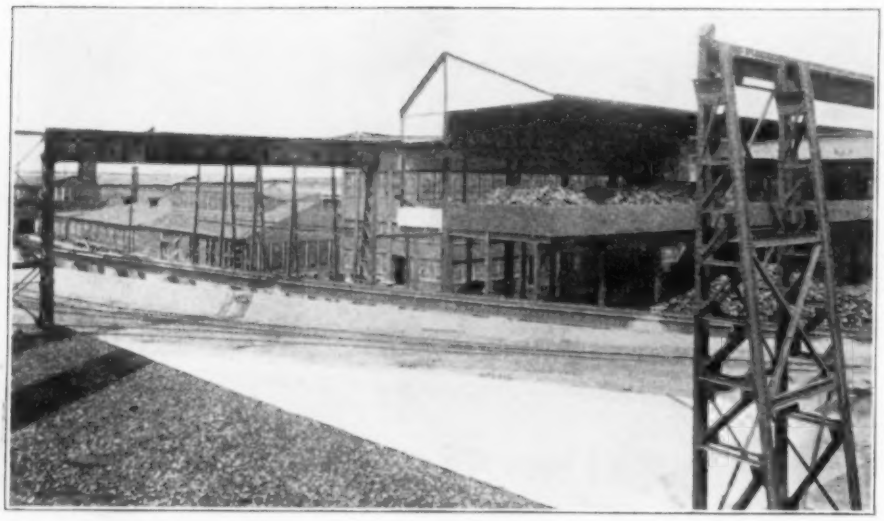


FIG. 11—THE COKE TRESTLE BUILT IN CONNECTION WITH THE GENERAL REARRANGEMENT OF THE YARD HAS BEEN EXTENDED TO SERVE THE CUPOLAS LOCATED IN THE OLD PART OF THE FOUNDRY

machine designed and built by the company for its own use is employed in cutting odd lengths of wire into short pieces of any desired length. The wires are fed through a row of openings in an upper revolving disk which passes a cutter mounted immediately below it. In effect the lower edge of each opening in the disk becomes one side of a shear, the cutter mounted below becomes the other side of the shear and the result is that as each wire passes this point it is cut to a certain length and dropped into a box under the machine. An adjustable plate may be set at any desired point below the cutter and this plate automatically regulates the length of the wire to be cut. An attendant stands near the machine and feeds odd lengths of wire into the openings and that is all the attention the machine requires.

Coreroom Layout

Other divisions of the coreroom besides the section devoted to the preparation of the wires include a wide space on each side of the ovens where the cores are made on one side by male employes and by female employes on the other side. The double row of ovens as shown in the plan view, Fig. 3, serves as a natural dividing area. Approximately one-third of the floor area or the part beyond that occupied by the ovens and the coremakers' benches is devoted to assembling and storage of dried cores. The remainder of the space in the coreroom is occupied by the girls' rest room and by racks loaded with cores for the following day's operation in the foundry. Production in the coreroom is maintained one day ahead of that in the foundry. The men's wash and locker room is located above part of the coreroom and is entered by a broad stairway leading from one of the side entrances to the building. The time clocks are located close to the wall in the passage between the entrance and the foot of the stairway so that the employes may stamp their time of entry and exit.

Mechanical equipment and jigs of various kinds are freely employed in assembling and fitting the cores before they leave the coreroom. For example, the crankcase cores are placed on a revolving table with a capacity for four cores. Each core in turn passes under a grinding disk which removes a trifling amount from the joint surface of the core. The cores are taken from this machine and placed on a conveyer which carries them past a number of girls stationed at suitable points. Each operator has a definite duty to perform, gaging, cleaning the vents, stopping vent rod openings and other features incident to preparing the cores for the molds. The cores are sprayed with blacking before they arrive at the end of the conveyor where they are removed and placed on racks preparatory to being carried into the foundry for the following day. The blacking dries at ordinary atmospheric temperature. Cores formed of halves pasted together are placed in the oven after they are blacked for a second drying. The entire core assembly for one cylinder is placed in a jig and passed through a long electrically heated oven which dries the paste and blacking and produces practically a complete set of cores joined to form a single unit. This arrangement insures positive alignment of the various parts and the proper metal thickness between the various component cores. Under normal conditions 125 girls are employed in the coreroom.

That part of the foundry in which the molds are made and poured is divided into three main sections, longitudinal and parallel to each other, bounded at one end by the coreroom

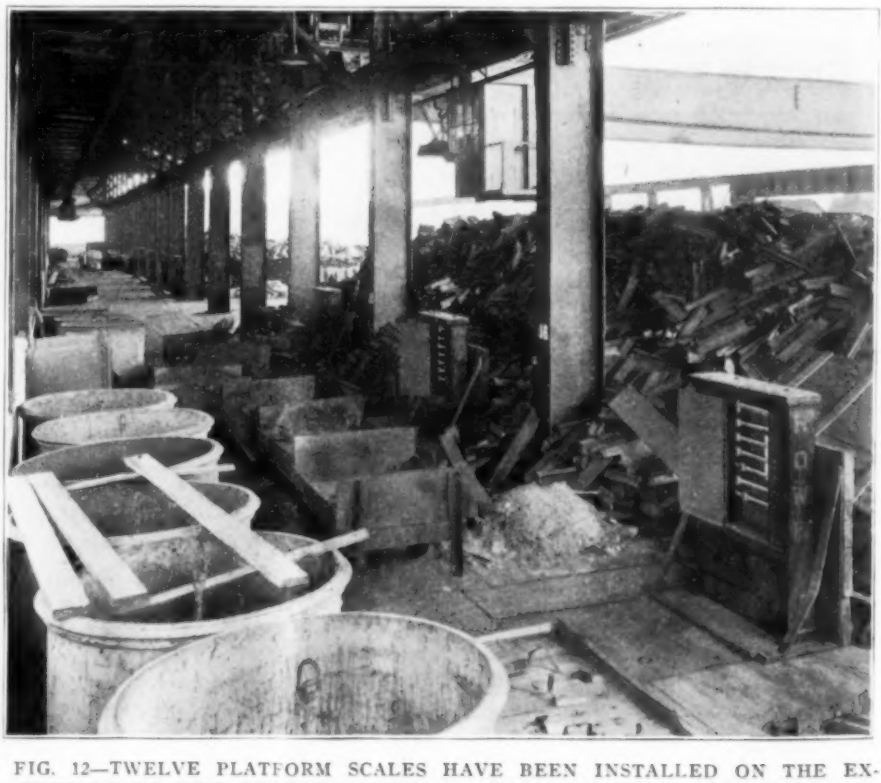


FIG. 12—TWELVE PLATFORM SCALES HAVE BEEN INSTALLED ON THE EXTENSION TO THE CHARGING DECK TO FACILITATE THE LOADING OF THE BUCKETS—THE CHARGING BOXES SHOWN TO THE RIGHT WERE EMPLOYED WHEN THE CUPOLAS WERE CHARGED BY HAND

and at the other end by the cupola department. All the castings are divided into three general classes and as nearly as may be practicable each class is confined to one of the main divisions of the building. The first section, which includes the old original shop plus the various longitudinal extensions, is devoted to bench work and general jobbing. A considerable part of the work consists of tire molds. Miscellaneous small castings, cylinder heads, fly wheels, sleeves, etc., are made in the center section. The third section is devoted altogether to the production of cylinders and transmission cases.

Elsewhere the statement has been made that the plant, buildings, methods and equipment almost constantly are in a state of transition and it well may be that another arrangement than that described may be in vogue by the time this description appears in the columns of THE FOUNDRY. This contingency is all the more probable on account of the large amount of floor space available since a continuous pouring system was installed in connection with two mold conveyors served by eight sand throwing molding machines made by the Beardsley & Piper Co., Chicago. A complete sand handling plant erected by the R. W. MacIllvaine Co., Chicago, serves the two molding units. Details of the system will be considered in an article to follow this dealing with several features of shop practice.

Melting equipment is located in a building 50 x 350 feet extending practically all the way across at one end of the departments devoted to making molds. The iron is melted in five cupolas lined to 72 inches diameter. An additional 60-inch cupola together with a smaller cupola hardly ever used, but held as a spare, are located in the old foundry and serve to melt the metal for the miscellaneous castings made in that part of the building. Each of the five cupolas is provided with a stationary, 5-ton, mixing ladle in front of the spout. The metal is poured from this ladle into the bull ladles suspended from a monorail which conveys the metal to the various floors in the different departments. A floating section in the monorail in front of each cupola is connected to a scale mounted on a column on the opposite side of the alley which extends in front of the battery of cupolas. Acting under instructions, the ladle tender fills his ladle with a definite amount of iron as indicated on the scale and takes it to a definitely designated floor. It is claimed that the iron saved by this method in a month paid for the scale installation.

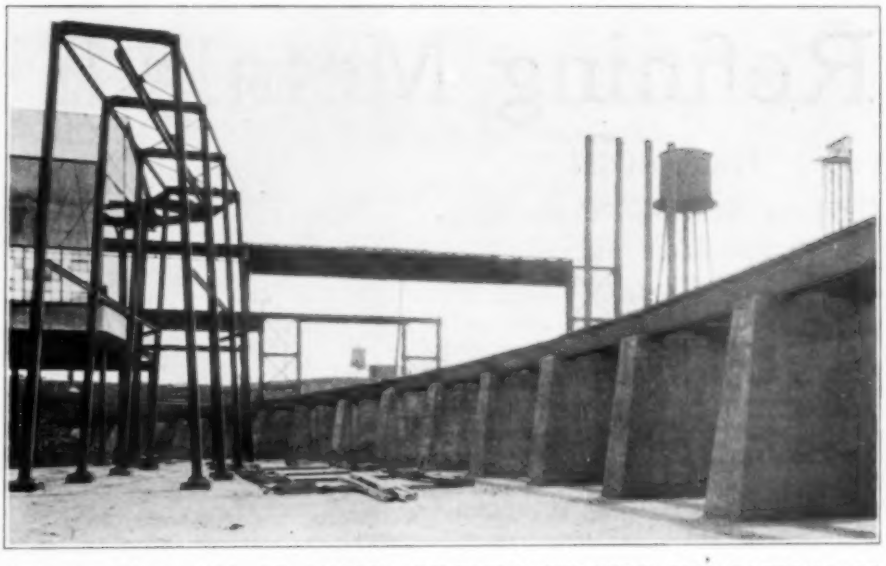


FIG. 13.—COKE WILL BE DUMPED DIRECTLY THROUGH THE BOTTOMS OF THE CARS INTO THE POCKETS FORMED BY THE CONCRETE PILLARS SUPPORTING THE TRACK

The cupola charging deck extends from one end of the cupola building to the other and is served by three elevators. Rather it should be said *was* served by three elevators. Recent change in connection with the charging deck has eliminated the elevators except as an emergency measure. The charging floor has been extended 50 x 400 feet to form a stock yard from which the material may be trucked directly on to the original charging floor. Several features in connection with this elevated stock yard are shown in a few of the accompanying illustrations. Particular attention is directed to Fig. 8 which shows the massive character of the construction. Concrete footings for the steel columns absorbed a car load of gravel for each group of three.

Elevated Stockyard

Formerly all the material coming into the stockyard was unloaded by a 10-ton crane supplied by the Whiting Corp., Harvey, Ill., and piled on the ground according to its classification. Since the elevated stockyard has been completed the same crane with a double magnet unloads pig iron, iron and steel scrap directly from the cars to the platform. Coke that formerly was unloaded on the ground and then taken to the elevators in buggies, now is dumped through a trestle, loaded into special charging buckets and lifted to the elevated platform by the hoist on a monorail.

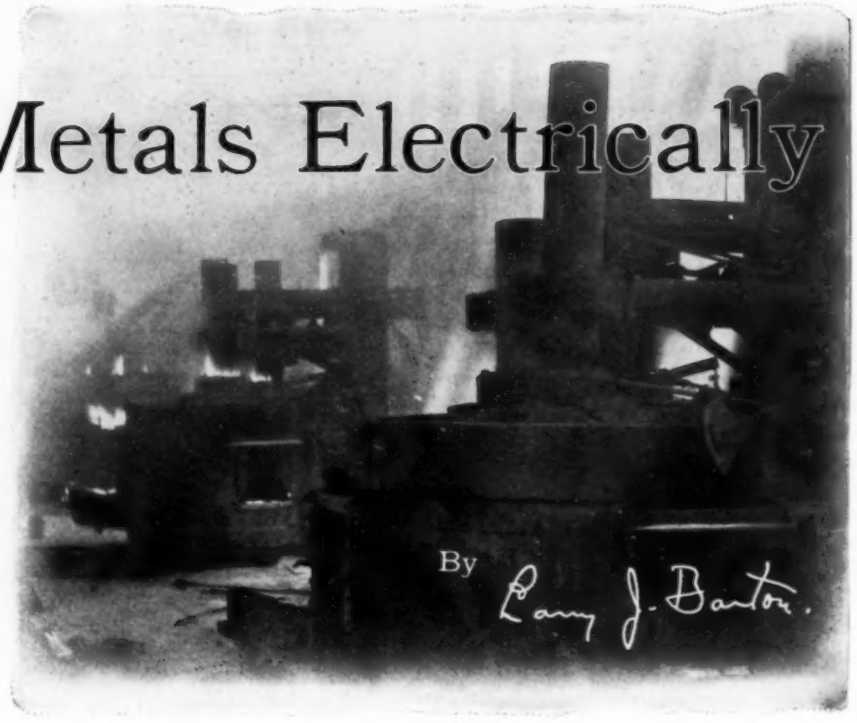
Charging machines, similar to that shown in Fig. 9, recently have been introduced to take the place of the hand charging methods formerly practiced. The machines were built by the Chisholm & Moore Co., Cleveland, with the electrical equipment furnished by the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. A ram which hangs suspended below the bridge has a traveling range that extends from the back wall of the building to the back wall of the cupola. Special circular buckets designed to hold a definite amount either of coke or iron are assembled on the charging floor. The bucket is provided with a loose bottom that rises as a cone in the center. The machine picks the bucket from the floor and at the point of the ram introduces it into the cupola. The operator releases the catch and the bottom drops a sufficient distance below the shell of the bucket to allow the material to fall through into the cupola. The cone formation of the bottom helps to distribute the charge uniformly. The proportion of pig iron, cast iron scrap and steel scrap varies according to the character of the castings to be poured from the mixture. Steel scrap is confined to rails cut to short lengths. The necessary amount of the various ingredients to form a charge of 3600 pounds is loaded into each bucket.

The new charging deck has a capacity of approximately two weeks supply of material for the cupolas. To facilitate loading the material into the buckets, platform scales in groups of four are located at three equi-distant points on the platform. In effect, the platform confers the same advantage as if the charging doors of the various cupolas were situated on the ground level. Interesting features in connection with the mold conveyors, sand handling equipment, cleaning the castings together with a description of the affiliated aluminum casting foundry will be published in an early issue of THE FOUNDRY.

Refining Metals Electrically

Chapter III

Carbon Steel—Purchasing Scrap—How Furnace Is Charged



AN ELECTRIC furnace making steel in the foundry is different from the furnace making extremely high grade products, in that economy is a prime requisite. Therefore, it follows that every possible saving must be made, both in purchasing materials and in production operations.

As scrap metal for the furnace charge is the material most handled and used, certain set rules should be laid down for the procedure under which this item will pass from the preliminary order until it is charged into the furnace.

In purchasing scrap, certain differences will arise, due to the size of furnace, contemplated regularity of operation, choice of process, whether acid or basic, etc. These features will affect materially the character of scrap metal brought to the works. Scrap steel can be roughly classed under the following headings: Size, character and composition.

The size will depend upon two points, the size of the furnace and the intended operation. If the furnace is of 1-ton capacity, with doors 18 inches square, the metal must be such as can be handled easily in charging and small enough to be placed quickly in the furnace. The latter is particularly important if operation is continuous. Under such conditions, the greater percentage of scrap should consist of such classes of material as heavy borings, nuts, bolts, rivets, punchings, short-sheared steel, heavy forge flashings, ingot butts, etc. These are small in size and may be shoveled in the furnace in a short time.

The direct opposite to this would be a 6-ton furnace where only one or two heats are made in a day. Here the doors are about 30 inches square, allowing a much larger size scrap and the time necessary to charge is not so important. Naturally, a cheaper grade of steel could be purchased, such material as structural butts, short pipe lengths, large plate shearings, mixed borings and turnings, miscellaneous forge flashings, etc. Such scrap usually is several dollars a ton less in price and while a longer time of charging would follow, there would still be a considerable saving in the final cost of the metal.

Regularity of operation is the deciding feature in the character of scrap purchased and depends also upon the process of operation. Where basic operation is used, it is permissible to allow a greater percentage of rust or dirt on the scrap, which is taken care of by the slag and has no ill effect upon the hearth. Dirty or heavily oxidized metal will corrode an acid hearth quickly unless carefully watched and allowances made for this oxide. This percentage of rust will depend upon the general character of the scrap, thin plate shearings having a much greater volume of oxide than ingot butts. This factor depends greatly upon the area of a unit of scrap. Consequently, for basic operations cheaper scrap is permissible allowing the use of bundled iron, old torn down machinery, boilers, etc.

Composition of scrap used is governed by the character of operation and the intended product and is handled under two main heads; the carbon percentage and that of phosphorus. If acid operation is to be used, it is mandatory to obtain a low phosphorus charge. Basic operations allow for phosphorus content considerably higher, due to the ability of this process partially to eliminate this undesirable element. The amount of carbon desired in the product will control the charge to a great extent, as either raising or lowering the carbon in the bath is to be avoided as far as possible. Consequently, if a soft steel is to be made, the charge will have to consist of such metal as will melt down sufficiently low, such classes of scrap as general structural, bolt and rivet stock, ingot butts from these products, old steel castings, etc., being particularly suitable. For higher carbon heats, the use of rail, old springs, etc., finds wide application.

Table XX gives the various classes of scrap on the market, together with their comparative costs as of 1921. While the prices today have changed in general, the ratio between the classes still exists. The difference in price between such items as machine shop turnings, light iron, stampings, forge flashings and axle turnings on

Where Size Counts

SIZE and weight play important roles. Nor is their influence confined to the realms of sport, as many might infer. In purchasing scrap metals for use in foundry electric furnaces, these elements are most important. They influence operating economy to a marked degree. They bear a definite relation to quality of product. Further, they influence the price of castings and through the proper choice of size and weight, coupled with attention to the chemical content, the foundryman may vary his costs materially. In the accompanying article, the author gives the points which should be watched in buying scrap. He recommends careful buying, orderly sorting and attention to charging methods. In the forthcoming installment of this series, details of melting practice in making plain carbon steel will be presented.

Table XX

Scrap Classifications, Prices, and Analyses

Prices per gross ton, Chicago

Class	Price	Percentage Carbon	Mang.	Sil.	Phos.	Sul.
Heavy melting steel	$13.00	0.15/0.30	0.60	0.10	0.05	0.05
Frogs, switches, cut	13.00	0.50/0.76	1.00	0.20	0.04	0.04
Shoveling steel	12.50	0.15/0.30	0.60	0.10	0.04	0.04
Low phosphorus melting	16.00	0.18/0.24	0.60	0.10	0.02	0.02
Forge flashings	8.50	0.10/0.20	0.50	0.10	0.04	0.04
Steel rails, cut	14.25	0.50/0.76	1.00	0.20	0.05	0.05
Axle turnings	9.00	0.38/0.52	0.80	0.20	0.04	0.04
Small structural	13.50	0.18/0.24	0.50	0.15	0.04	0.04
Steel axles, cut	11.00	0.38/0.52	0.80	0.24	0.05	0.05
Railroad wrought	14.00	0.05/0.15	0.40	0.10	0.12	0.04
Knuckles, couplers	14.50	0.55/0.70	0.70	0.40	0.06	0.05
Springs, coiled	15.50	0.95/1.05	0.40	0.20	0.03	0.03
Punchings, low phosphorus	13.00	0.10/0.24	0.60	0.10	0.02	0.02
Locomotive tires	12.50	0.50/0.85	0.75	0.35	0.05	0.05
Machine shop turnings	5.00	0.18/0.30	0.60	0.20	0.05	0.05
Light iron	5.00	0.05/0.15	0.40	0.10	0.12	0.05
Stampings	7.00	0.10/0.20	0.50	0.10	0.05	0.05

Manganese, silicon, phosphorus, and sulphur given as the maximum in each case.

one hand and heavy melting steel, low phosphorus melting, punchings, etc., on the other, will be noted. The difference in this instance depends directly upon the ease of handling.

Charging a heat of punchings in a 3-ton furnace will take approximately 5 minutes per ton, while charging a similar size heat of light scrap will take probably three times as long or 15 minutes per ton. This extra time for two laborers at 30 cents per hour will amount to only 10 cents per ton, while the difference in cost of scrap is several dollars. Of course, one other point determines this difference in price, that is melting loss. The general scrap prices are based upon the supply and demand of the large open-hearth shops which cannot use light scrap due to its heavy oxidizing loss in their process. Under electric furnace operation, this is not a fact, the amount of loss for light scrap amounting to about 2 or 3 per cent above that of a chunky charge. The total saving per ton on using such scrap, therefore, is about $2 per ton of hot metal.

Scrap should not be purchased in an indescriminate manner, but should be selected carefully after a thorough examination of all the prerequisites, as a few dollars difference in the price of the initial charge will make a decided change in the cost of the finished casting.

The scrap should be selected over as wide a range as possible, that proper selecting for each individual heat may be made, the idea being to have as well balanced a charge as is possible. Such a charge should be selected as to size of scrap and composition, the aim being to obtain one which will melt down to the desired point with a minimum of power and labor. A charge of loosely packed scrap will take a longer time to melt than one which is compact. In the same manner, any needless elimination of phosphorus by slagging off results is an added expense.

When the scrap metal comes into the yard it should be unloaded with a magnet and segregated as much as possible. All heavy pieces should be kept by themselves as should shoveling scrap, scrap which is either extra clean or heavily oxidized. Pieces of irregular size which are hard to charge should be kept in one pile. There should be a further separation according to carbon content and in some cases when any high phosphorus scrap is received, it should be placed by itself. If this is done it is easy for the melter to make up his heat with a minimum of time and effort. When scrap is all piled in one heap, it often requires considerable time to pick it over to make a special heat.

Making Up the Charge

In the preparation of the charge for any specific heat, several points should have consideration. The charge must be of such chemical composition that when melted down it will give an analysis permitting finishing with a minimum of trouble. The sizes of the scrap must be so chosen as to enable the metal to be placed in one compact mass in the furnace. Further, such choice must be used as will insure a proper charge at the lowest possible cost for the metal. That innumerable combinations satisfy these points is admitted, but there is always the one best method for each set of conditions.

FIG. 23—RECOMMENDED PRACTICE FOR CHARGING SCRAP IN ELECTRIC FURNACE

Tables XXI, XXII and XXIII show several varying methods of arranging the charges for certain specified heats.

Assuming that the different components of the charge have been decided upon, the procedure will be to place it in the furnace as shown in Fig. 23. The large, heavy chunks are spread over the entire hearth, especially in the direct path of the electrodes as they dig downward. This delays their downward progress sufficiently to allow a small pool to form in the center of the hearth before the electrodes have reached this point. This is a safeguard against any tendency to arc against the bare hearth with its attendant bottom trouble. The interstices are filled with smaller scrap and care is observed to so arrange the upper layers of the charge that there is small likelihood of *bridging*.

The center core of the charge always should be of such a nature that as soon as it is slightly undermined by molten metal it will readily slip in and under the electrodes. The best class of scrap for this central portion is heavy turnings or similar small sized metal which does not tend to bond itself in one unbreakable mass.

The method of charging this scrap will depend upon the type of furnace being used and whether hand or machine charging is used. On such furnaces as the Heroult, Greene, Ludlum, etc., up to 6 tons in size, hand charging is the only possible method. If the furnace is on the floor level, the scrap must be placed in cans or boxes and lifted up by the crane. In either method, the carrier will be directly filled by the electric magnet and weighed before being charged, either on a platform scale or on a spring scale suspended from the crane. The scrap is dumped before the furnace doors and thrown in as quickly as possible. Extremely large chunks may be handled readily on a *peel* or long tong arrangement suspended from a swing crane, while such classes of metal as punchings, heavy turnings, nuts, rivets, etc., may be handled with shovels.

This hand charging is at the best a slow process and constitutes one of the greatest delays met with in electric furnace operation. While heavy scrap capable of being handled with shovels may be charged quickly, such classes of metal are to be had only

Table XXI

Typical Scrap Mixture

Varying methods of making up a charge with a carbon content ranging from 0.20 to 0.30 per cent, intended for soft steel castings, the heat to shape itself with a minimum of effort on the part of the furnace crew. Assume shop scrap to contain 0.25 per cent carbon, and to have a value of $12.00 per ton. Other values taken from Table XX.

Component parts	Percentage	Cost gross ton	Carbon percentage
No. 1			
Shop scrap	15.00	$ 1.80	0.038
Machine shop turnings	20.00	1.00	0.050
Small structural	50.00	6.75	0.120
Forge flashings	15.00	1.28	0.025
	100.00	$10.83	0.233
No. 2			
Shop scrap	15.00	$ 1.80	0.038
Shoveling steel	15.00	1.88	0.038
Heavy melting steel	15.00	1.95	0.038
Stampings	30.00	2.10	0.045
Forge flashings	25.00	2.12	0.038
	100.00	$ 9.85	0.197
No. 3			
Shop scrap	15.00	$ 1.80	0.038
Axle turnings	30.00	2.70	0.135
Light iron	10.00	.50	0.005
Machine shop turnings	20.00	1.00	0.040
Punchings	25.00	3.26	0.045
	100.00	$ 9.26	0.263

Table XXII

Typical Scrap Charge

Methods of making up a charge with carbon content of from 0.40 to 0.50 per cent, for medium hard steel castings.

Component parts	Percentage	Cost gross ton	Carbon percentage
No. 1			
Coiled springs	30	$ 4.65	0.300
Axle turnings	20	1.80	0.090
Forge flashings	35	2.97	0.052
Shop scrap	15	1.80	0.038
	100	$11.22	0.480
No. 2			
Shop scrap	15	$ 1.80	0.038
Knuckles	30	4.35	0.186
Locomotive tires	25	3.13	0.160
Machine shop turnings	30	1.50	0.072
	100	$10.78	0.456
No. 3			
Steel rail	50	$ 7.13	0.310
Heavy melting steel	10	1.30	0.022
Axle turnings	30	2.70	0.136
Stampings	10	.70	0.015
	100	$11.83	0.483

in small lots and then usually at a stiff premium. To overcome this loss of time there have been many different methods advocated.

One furnace is so constructed that the roof may be tilted back, allowing the interior to be filled from the top. The manufacturers of this furnace advocate preheating the scrap in oil fired ovens, charging in drop bottom buckets and placing the scrap in position from above. While this method is good when considered from the standpoint of power saving, difficulty is encountered from the roofs. The constant exposure of a white hot refractory to the cold air when the roof is lifted may result in rapid deterioration of the brick, with a short roof and wall life.

Another type furnace has the main charging door directly in the rear of the furnace which makes possible the use of gravity in charging through the door, without raising the roof or otherwise exposing the refractories to cold air. This system makes use of a charging box, which is made of steel plate in the form of a long box, being approximately 24 inches square and about 8 feet long. This is mounted on wheels so arranged that when rolled up to the furnace, the front end of the charger is in line with the door opening. The front of the box is inserted in the door and latched into position. The rear end of the box is lifted by the crane, the furnace being tilted forward as the box rises. When the maximum furnace tilt is obtained, the rear of the box is about 10 or 12 feet from the floor at an angle of 45 degrees. Upon striking the box with a bar, the charge slides into the furnace.

Such a box will hold from 3000 to 5000 pounds of scrap, depending upon its character and takes approximately 10 minutes to charge. This is extremely fast work and naturally results in shortening the time between heats to a marked degree.

However, two disadvantages are encountered in this method of charging. When this charge slides into the furnace, there is naturally a heavy impact. The scrap is thrown heavily upon striking and impinges against both the roof and upper side walls. The result is a gradual weakening of the refractory resulting in short life of both roof and wall. The most severe disadvantage is the building up of the hearth. When this charge of scrap strikes, it loosens all of the patching material on the banks which drops into the bottom of the furnace, with the result that the side walls tend to go down and the hearth rapidly builds up.

These buckets were used in a 3-ton installation under the writer's supervision over a period of several months, but were discarded. In one particular instance, the acid hearth built up 8 inches in thickness during one week

Table XXIII

Typical Scrap Charges

Charges for extra hard steel castings running from approximately 0.70 to 0.80 per cent carbon.

Component parts	Percentage	Cost gross ton	Percentage carbon
No. 1			
Coiled springs	45	$ 7.00	0.450
Knuckles, couplers	35	5.10	0.217
Locomotive tires	20	2.50	0.130
	100	$14.60	0.797
No. 2			
Steel rail	50	$ 7.13	0.320
Axle turnings	40	3.60	0.180
Heavy melting steel	10	1.30	0.022
Carbon (coke)	11 lbs.	.05	0.260
	100	$12.08	0.782
No. 3			
Heavy melting steel	20	$ 2.60	0.044
Punchings	20	2.60	0.036
Axle turnings	30	2.70	0.135
Stampings	30	2.10	0.045
Carbon (coke)	22 lbs.	.11	0.520
	100	$10.11	0.780

while the charging bucket was in use. Since discarding it, there has been no thickening of the hearth, this period being over 8 months. In every case where the bucket was used, the front part of the furnace roof gradually was knocked to pieces by the scrap striking against the brick, requiring constant patching to keep the roof in service.

In furnaces of 10 tons in size, the standard charging machine, as used in open-hearth work, has found some use. In a shop in Buffalo where two 10-ton Heroults are in service, the charging machine has been in use for some time. A charging machine also is used in a 6-ton Ludlum furnace operating in one of the prominent eastern shops. If the furnace is of such a size as to allow of the entrance of a charging bucket, this system of operation may be used, but it involves a heavy installation cost which the writer does not believe to be justified by the saving. Smaller furnaces naturally cannot consider such an arrangement.

One special installation is arranged so that the entire furnace hearth rolls on wheels. When the heat is poured, the furnace is patched and the hearth run out from under the roof. The scrap, which has been weighed previously, is charged quickly with an electric magnet, the hearth being run back into place as soon as charging is completed. It is claimed that only 7 minutes is taken for thus charging a heat of 6 to 7 tons, from the time the hearth is run out until the current is on again. It seems as if the same objections would hold as for the system using the removable roof, namely rapid refractory disintegration. As most of the furnaces with the rolling hearth use magnesite brick for the entire wall, it would be imagined that the spalling loss would be severe.

Another company recently has placed on the market a furnace embodying a rather new principle. The installation consists of two complete furnaces mounted on an arrangement allowing of rotating the entire setup. One transformer and only one set of electrodes are used. One of the furnaces is charged and the heat melted. During this melting the other furnace is being charged. As soon as the first furnace has poured its steel, the electrodes are raised clear of the roof and the setup rotated so that the second furnace is in melting position. The electrodes are lowered and melting starts on the second unit. The total delay between heats is not over 5 minutes. Whether or not the added cost of equipment will counterbalance the elimination of delays remains to be seen.

Makes Wheels and Brakeshoes

(*Concluded from Page* 712)

decreases with the size of the wheel down to ¼-inch chill which is considered proper for light buggy wheels employed in mines and other places of a like character. In making up the charge for the day, the iron for the largest wheels is placed in the cupola first and followed by the iron for the medium and light wheels in the order indicated. Chemical and physical tests of the iron are taken from every heat. Cast iron, chilled, car wheels are expected to conform to exceedingly close and rigid specifications and every step in the process of manufacture must be watched closely and checked frequently to insure a satisfactory and uniform product.

Brakeshoes for Canadian railroads are made in this plant under an agreement with the American Brakeshoe and Foundry Co., New York. This company controls the methods of manufacturing and applying the various styles of steel inserts designed to improve the life, the safety and the traction quality of the shoes. The American company erected and equipped a building adjoining the foundry where the steel inserts are formed in suitable presses, but the Canadian company operates it as part of its plant. Some of the inserts, for example, those shown in Fig. 11 are formed from several thicknesses of steel mesh while others shown in Fig. 12 are quite elaborate and are stamped from steel plate, afterward heated and bent to the required shape under a powerful punch press. The former type of reinforcement is employed in shoes designed for passenger car service. The steel plates are placed in locomotive driver shoes.

Approximately 15 tons of brakeshoes in various styles and sizes are cast daily. The driver shoes, shown in Fig. 12, are the largest and are cast singly in individual flasks. In addition to the steel plate attached to the cope side of the mold, a number of hard, crucible-steel inserts are placed in the drag part of the mold. The drag inserts are dipped in machine oil and then laid on the bottom of the mold. Two nails are driven into the sand to hold the piece of steel nearest the gate, but the others are not secured in any manner. They retain their place simply through gravity. The steel plate is oiled and dusted with silica flour.

The cope flask is provided with two, ¾-inch rods instead of the usual bars and the steel plate is suspended from these rods by short pieces of light wire reeved through the holes in the plate. The wires are looped over the rods with the ends inserted in suitable holes in the pattern before the sand is rammed in the cope flask. After the cope is lifted off the molding machine, the steel plate is set into place and the ends of the wires are pulled tight and twisted to hold the plate in place when the cope once more is inverted over the drag.

Patterns for the various castings are mounted on plain stripping plate machines made by Henry Pridmore, Chicago. The machines are arranged in pairs at the end of each floor with the cope part of the pattern mounted on one machine and the drag part of the pattern mounted on the other. The large patterns are mounted singly, but the small patterns are mounted in pairs. One man works on each floor and makes from 70 to 100 molds depending on the size of the flask. Each floor is arranged as shown in Fig. 11 for four rows of flasks with a cast iron gangway between the first and second and the third and fourth rows. The gangway is for the benefit of the buggy ladle shown in Fig. 1, from which the molds are poured. This ladle holds about 300 pounds of iron, sufficient to pour seven or eight molds. It is mounted on a special carriage equipped with ball-bearing wheels and the end of the shank near the handles is counterbalanced in a manner that renders the operation of pouring comparatively easy for one man.

Scrap brakeshoes, grates and other railroad scrap make up the greater part of the charge in the cupola where the iron is melted for the brakeshoes. The resulting iron conforms approximately to the following analysis: Silicon, 1.40—1.60 per cent; sulphur, 0.08—0.10 per cent, phosphorus, under 0.50 per cent; manganese, 0.50—0.70 per cent; low total carbon.

Other buildings in the plant group include a well equipped chemical and physical testing laboratory, a pattern shop, machine shop operated principally on maintenance and repair work, a stock room containing materials and equipment used in the operation of the works, a power house containing the pumps, blowers and compressors and a cleaning room provided with the usual tumbling barrels and grinding stands. A welfare building located close to the general office is provided with hot and cold water baths and facilities for the employes to change their clothing upon entering and leaving the plant. Instead of hanging the garments in lockers, they are suspended from hooks in the ceiling where they are dried and ventilated thoroughly in a current of air regulated by suitable devices in the walls of the building. One room in the building is equipped with the necessary materials and appliances for rendering first aid in case of accident to an employe.

Experimented With Permanent Molds

EDGAR ALLEN CUSTER, engineer, scientist, inventor and pioneer in many phases of what constitutes modern foundry practice is a native of the sovereign state of Pennsylvania and is descended from a long line of Dutch and English settlers which numbers among its members the dashing cavalry officer whose life was cut short so tragically at the battle of the Little Big Horn during the Indian uprising of 1876.

At one time or another in an exceedingly variegated career, Mr. Custer has missed by a hair's breadth the swing of the scythe in the hands of the grim old reaper, but a glance at the attached illustration will indicate to all and sundry that he is *not* down hearted. He was born at Altoona, Pa., March 28, 1862, at a time when the war clouds hung black and low over the neighboring states of Virginia and Tennessee. Altoona then as now was the home of the great shops of the Pennsylvania railroad. It also was the home of Bill Hare and his brother Johnny, the only men in the country who could cast a locomotive cylinder and of Archie Maxwell who broke every pig in the yard to get soft iron.

Unlike most foundrymen and others who eventually attained to positions as captains of industry, Mr. Custer's youth was spent in luxury. At the age of 10 his parents allowed him 50 cents a month pocket money to be spent in any manner that pleased his fancy. This munificent sum represented the stipend or honorarium he was granted every month for pumping the organ on Sunday in the First Presbyterian church. Without doubt this early musical education is responsible in large measure for the taste and proficiency he afterward displayed as a manipulator of the violon cells.

During his school days he fostered a secret ambition to become a freight brakeman and to wear high heeled shoes and spring bottom pants. He still has a hankering for the wild free life of the birds of passage and their picturesque appendages, but fate, cruel fate, first in his parents and later in the person of a sensible wife, effectually has frustrated his gentle and laudable ambition. His parents insisted on sending him through the university where he was graduated as a mechanical engineer. His wife refused absolutely to tolerate the high heels and the spring bottom pants.

Upon completing his school work, the young man was promised a position by an elder brother who was connected with a railroad in Mexico. He promptly decided to marry and take his bride on a honeymoon trip to the southern republic. The day before the wedding he received a message—collect—to the effect that one of the periodical revolutions had broken out in Mexico, the railroad was wrecked, what was not wrecked was in the hands of the rebels and his brother had just managed to hop the Rio Grande with nothing but the clothes in which he stood.

The prospective job was gone, but a wedding is a wedding. It is something that cannot lightly be ignored. The young man went gallantly through the ceremony according to the original schedule and then proceeded on his honeymoon to Cleveland—on a pass. In Cleveland the young couple were guests of the late Gen. Caldwell, at that time president of the Nickel Plate railroad. The general inquired casually as to the young man's prospects and upon learning that he just had none, kindly said tut, tut, and gave him a position in the railway offices, where he remained for six years.

Our hero was advanced from time to time, but his family increased faster than his income and he became a political cartoonist on the *Leader* during his spare time. The *Leader* was a republican newspaper, but when the *Plain Dealer* offered the artist one dollar more per week for his services he promptly transferred his allegiance and thereafter held his old friend the elephant up to the scorn of all intelligent readers on the sharpened point of an ironic and sometimes satirical pencil.

Seeing no future as a railroad draftsman, he ripped a half finished drawing from his board one day and announced to the horrified general superintendent that he was resigning right there. The h. g. s. agreed with him instantly and enthusiastically. He also told him never to come back. E. A. gathered together his goods and chattels and trekked to Philadelphia where he secured a job as handyman in the foundry of the Baldwin Locomotive Works at 20 cents an hour. However, that was only temporary. He was advanced rapidly from one important executive position to another until he resigned in 1896 to become manager of a large chemical plant.

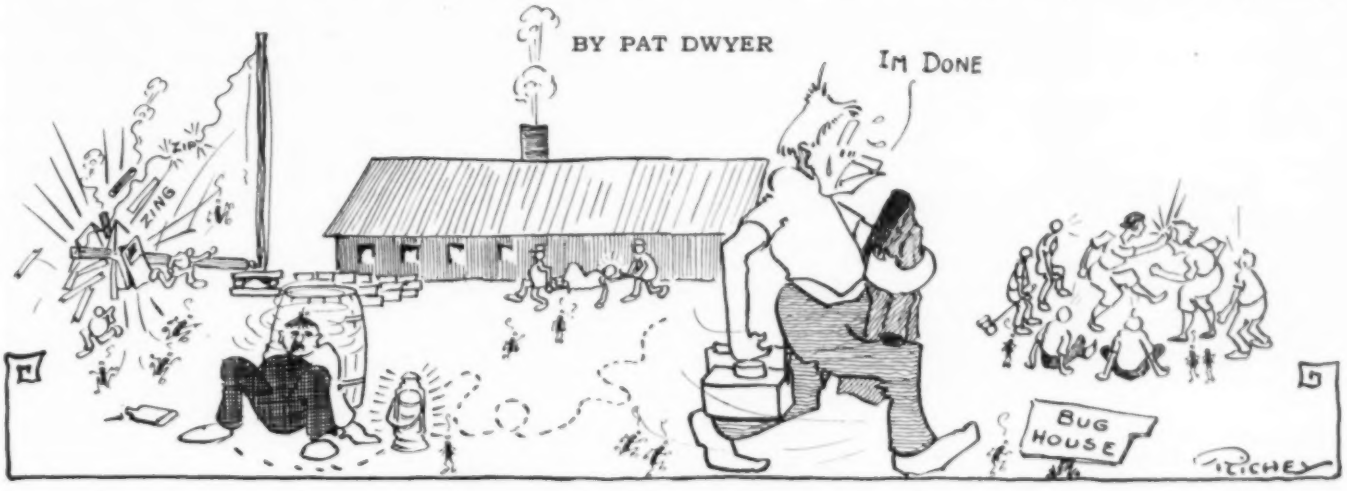
He remained in that position until 1902 when he re-entered the metal field as president of an iron company. While with this company he carried on the extended series of experiments with permanent molds with which his name is most closely identified with the foundry industry.

For several years before the war, he engaged in private consulting practice. He was one of the first to receive a commission after the United States entered the war and in a consulting and confidential capacity he served Uncle Sam so strenuously that when the war ended he was too tired to even get a thrill from watching a locomotive pull a string of freight cars a mile long. With Mrs. Custer he embarked on a long sea voyage to South America. The vessel was wrecked off the coast of Peru and the passengers were rescued at sea.

Without a word of Spanish they traveled peacefully through several countries, ate native food and even crossed the Andes in a decrepit Mercedes automobile. The greater part of the journey was made either on foot or on mule back. They almost became mixed up in a young revolution at one time. Taking it all in all, Mr. Custer decided he had made a mistake in leaving home in search of peace and in leaving work to seek rest. Since his return to the United States he has been connected in a consulting capacity with the Baldwin Locomotive Works, Philadelphia.

Bill Makes an Oil Separator Casting

BY PAT DWYER



"SOME day," said Bill morosely the other night, "I am going to quit the foundry. Quit it cold and for keeps. It is a nerve-racking, thankless job and so far as I can see only leads to one of two places, the poorhouse or the bughouse. Good enough places in their way, I dare say, but I have not the slightest ambition or desire to turn up my toes for the last time in either one. If it isn't one thing it is something else in the foundry from morning until night and I have a good mind to quit now while the quitting is good."

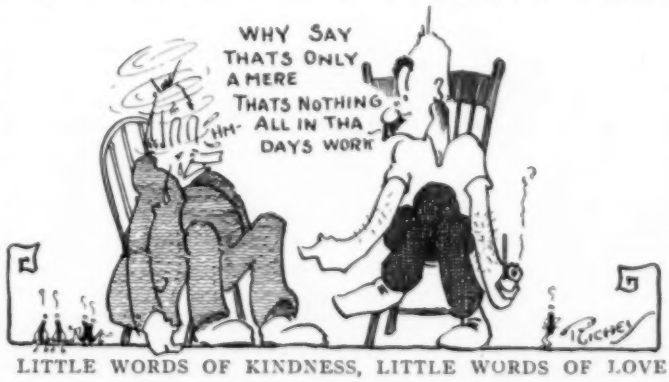
Naturally, I was somewhat surprised to find Bill taking such a gloomy view of conditions. Usually, I might say invariably, he is in an optimistic frame of mind and I inquired rather anxiously if something untoward had happened during the day to affect his equanimity, or to use one of his own expressions, to put him on the blink.

"Well" said he "I'll tell you. I cannot truthfully say that this day has been any worse than others which have preceded it or others that inevitably will come afer it. It has been just typical, that's all, just typical. I know many other words in which I could describe it to better advantage, but I am all in and we will just let it go as typical. Listen for a minute while I touch on a few of the high spots that helped, you might say, to relieve the day's performance of any tendency toward *ennui*. The watchman got tanked last night to such an extent that apparently he did not know his right hand from his left, but of course as is usual in such cases, a trifle like that caused him no uneasiness or did not disturb his night's sleep. He was instructed to shut off the oil in the core oven burners at 10 p.m., but the burners in the mold oven were to be left burning all night. Evidently he retained some glimmerings of intelligence for a few hours in the fore part of the night. Intelligence or instinct, I don't know whether I should call it one or the other. Call it by what name you will, it prompted him to shut the heat off in one oven and leave it on in the other. So far he followed instructions as well as any human being reasonably might be expected to follow them. In fact the only point on which he technically was open for censure was that the pickled Yahoo shut the heat off in the wrong oven.

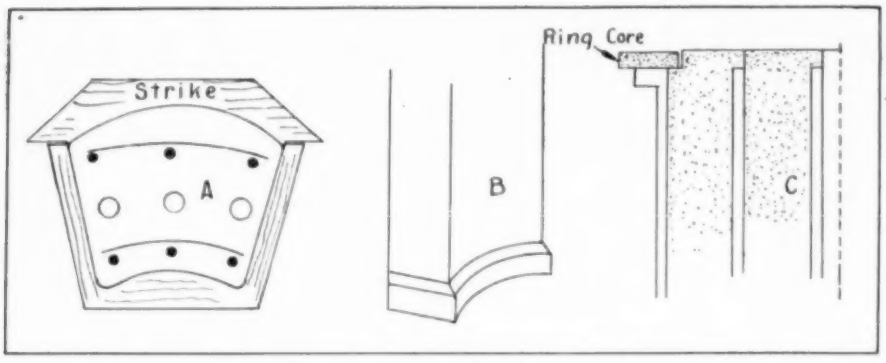
"As a result the cores were burned to ashes in one oven and the molds in the other oven were almost as green in the morning as they were when they were loaded on the cars the preceding afternoon. The coremaker profanely reported the catastrophe to me in the morning and then piously suggested that it would be a holy and a wholesome thought to spear the watchman and toast him to a crisp over a slow fire. I told him he had my unequivocal and enthusiastic permission to go as far as he liked and as an after thought I suggested that he hang him head down.

"About an hour afterward while the cupola tender was engaged in chipping away the ridge of slag above the tuyeres, a brick in the vicinity of the charging door sill became dislodged and struck him on the head in its descent. Had it fallen flat it probably would have bounced off, as many others had bounced off the old lad's knob in his early days when he had considered it his duty and his privilege to engage in as many controversial parades as possible. In this instance the brick fell in such a manner that the sharp corner made a three-corner dent in his scalp. He was carried fainting into the office and after a little first aid treatment, internal and external, he insisted he did not feel equal to return to the job until the following day. In this land of the free and the home of the brave you cannot make a man work if he does not want to work. I had to depend on his assistant to get the cupola ready for the day's heat.

"This assistant was willing enough and since he had been helping the regular cupola tender for some time I assumed that all he needed was a few general instructions. In the excitement of his first responsible position he forgot to ram a sand bed on the bottom and dumped his shavings and kindling wood directly on to the iron bottom doors. The mistake was not noticed until after the fire was lighted and sparks commenced to drop through the openings. We had to drop the bottom and start over again. About 3 o'clock two of the lady coremakers got in a clinch over the possession of a core plate and when I arrived on the scene a few minutes later I found the entire force taking part in the quarrel to the best of the ladies' vocabulary and believe me those ladies could talk. I had to threaten to fire the entire gang before peace—comparative peace—was restored



LITTLE WORDS OF KINDNESS, LITTLE WORDS OF LOVE



A SECTIONAL VIEW OF THE CHAMBER COREBOX WITH RODS AND STRIKE IN POSITION IS SHOWN AT *A*—DETAIL OF THE DISTANCE PIECES ON THE UPPER AND LOWER ENDS OF THE CHAMBER CORES IS SHOWN AT *B* AND THE MANNER IN WHICH THE RING CORE COVERS THE FLANGE IS SHOWN AT *C*

and before I could learn who was responsible for the uproar. You would think the foregoing furnished enough excitement for one day. Listen. You ain't heard nothing yet.

"I hurried from the coreroom to the charging deck to see how the work was going up there. I should not have been at all surprised to find that one of the gang had dropped a fat pig on his toes or had been run over by a charging buggy. I was agreeably astonished to find everything proceeding peacefully. Crossing my fingers I started down the stairway only to meet a wild eyed wop dashing madly up the steps in search of da boss. The only words I recognized out of the torrent he sprayed at me were 'de derk! de derk!' I followed him out into the stockyard and found another wreck.

"Contrary to constantly repeated instructions, the gang of huskies had hung a load on the derrick beyond all reasonable limits. The boom had carried the load while in an almost vertical position, but when the operator on the hoist lowered the boom to an almost horizontal position and attempted to swing the load, two of the guy ropes parted and the mast came smashing down on top of the house that sheltered the operator. Fortuately no person was killed or even crippled and I suppose I should have been overwhelmed with relief at the discovery. My first feeling was one of relief, but my second, I regret to say was one that never would have earned me a martyr's crown. I don't think I am any more vindictive than the average citizen, but I don't believe I would have shed a tear if the whole misbegotten gang had been driven into the ground like so many piles. Confound the foundry," said Bill, plaintively, "Some day I am afraid it is going to get my goat."

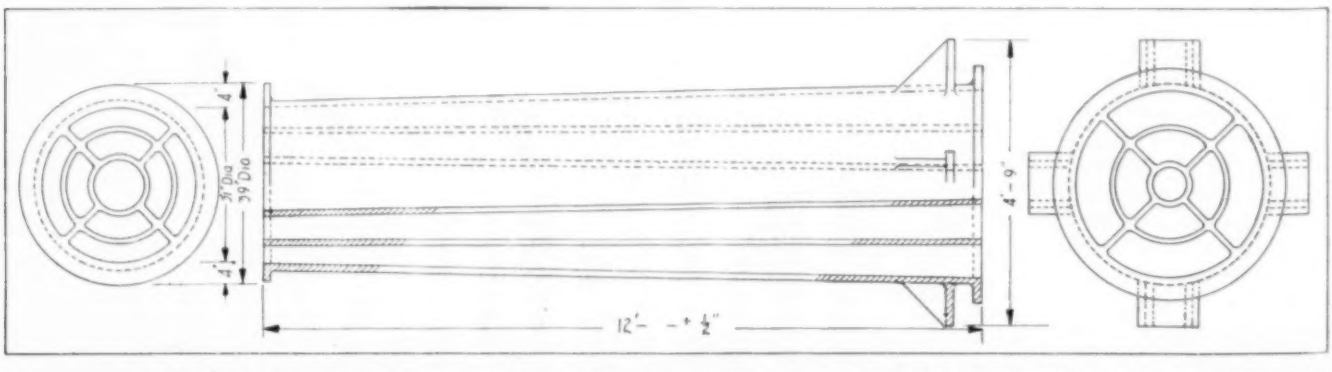
Actuated solely by the laudable intention of cheering him out of his apparent fit of the blues I told him he should not be unduly downhearted over trifles of that character. I quoted the well known saying that into every life some rain must fall and all that kind of thing. Besides it was all in the day's work. Every job would be dead and monotonous if it were not for a little variety once in a while.

"Monotonous?" said Bill. "Believe me kid, if lack of monotony is all that is required to keep a business alive, the foundry business is one that never will die. There is more variety to the square inch in a foundryman's life than there is to the square mile in the existence of any other created human being. He is constantly between the devil and the deep blue and salty sea. In his endeavor to escape the prongs of the pitch fork in the hands of one he jumps into the other and has salt rubbed into his wounds. When his order book is full he cannot get men and when men are plentiful all the orders go into hiding. If he rigs a plant to make light castings he discovers that the only customers in the country who want any castings are manufacturers of rolling mill machinery. If he installs equipment for handling heavy work he may consider himself lucky if he does not find his 50-ton crane half the time engaged in lifting copes from flasks that would have been lifted by hand by a pair of old time molders.

"When every other source of trouble fails he always can rely on the designer of new machinery to demand something in the way of a casting that is in direct opposition to every foundry principle. At other times he designs a casting in such a manner that the foundry expense is out of all proportion to what it should be, or to what it would be if the foundryman had been consulted before the pattern was ordered. Sometimes a pattern that is quite suitable under one set of conditions is of no service under a changed set of conditions."

To support his contention he pulled a blueprint, reproduced in the accompanying illustration, out of his pocket and explained that he had received it a few days before from an old friend who wanted his advice on the best method of molding the casting in a foundry equipped with a crane with a maximum lifting capacity of 15,000 pounds. The estimated weight of the casting is 9000 pounds. He also showed me a copy of the reply he sent and since it is more concise than the elaborate description he furnished me I am reproducing it here.

"The problem presented in your letter of recent date presents many interesting features, not the least of which is your limited crane capacity. Several methods are available for making the casting, but local conditions will determine which is the best in your foundry. With a free and unlimited choice in materials, methods and equipment, an experienced molder would sweep the mold in loam. This



SIDE AND END VIEWS OF A 5-TON OIL RETORT CASTING IN WHICH THE CORRECT LOCATION OF THE CORES PRESENTS AN INTERESTING PROBLEM

method entails a minimum amount of pattern expense and insures a mold in which the walls will be straight and true to dimension. The pattern equipment will include one short straight sweep for forming the bottom of the mold, one long sweep with a short projecting member near the top to form the outside wall of the mold including the upper flange; a bottom flange in 6 segments to be drawn in after the outer wall is built; three coreboxes, one for the large chamber, one for the small chamber and one to form the bracket feet under the large diameter flange. The long round core for the center may be swept in loam on a 4-inch barrel.

"Perhaps the most satisfactory method of answering your question will be to briefly outline the various methods applicable to the job and then consider each in turn and somewhat in detail. In that manner you will be in a position to determine which is the most suitable under the conditions existing in your foundry. The first method has been described. The others follow:

2—The loam mold may be built vertically inside a round flask or in a pit in the floor and may be formed all in one piece or parted in the center for convenience in placing in the oven.

3—The mold may be swept upright in sand in a deep pit in the floor and the mold may be dried with a suitable fire basket, a gas jet or by hot air driven in by a fan.

4—Where a pattern is provided it may be molded on end either in a pit in the floor or in a number of round flasks built one on top of another to the required height.

5—Under certain conditions the mold might be swept in two half flasks horizontally, dried in that position and then turned up on end to be cored and poured.

6—The mold might be made from a full split pattern in the same manner. In either case the top of the mold might be covered with cores or a flat cope.

"Assuming that No. 4 method conforms more nearly than any other to your local conditions, let us consider it somewhat further in detail. A plain tapered cylinder will serve as a pattern, with the 39-inch flange turned separately and attached temporarily to the body by a number of spikes inserted from the inside. The 48-inch diameter flange may be attached to the pattern permanently. A plain 31-inch diameter core print, 3 inches thick is attached to the small end of the pattern. The upper end is made plain with a loose circular panel in the center. The four brackets are formed separately and are screwed to the pattern from the inside. These screws later are released before the main pattern is drawn out of the mold. Access to the interior of the pattern is had through the upper end of the main pattern when the center panel is removed temporarily. The main pattern is constructed in the usual manner from long staves nailed to a number of circular frames.

"The corebox for the outer set of cores is a plain trough with a 1-inch recess at one side of the small end and on the short arc to form the distance piece between adjoining cores. A shoulder is formed at the outside of the large end to serve as a seat for a covering ring core. This detail perhaps may be more clearly understood by referring to the accompanying sketches *B* and *C*. The cores for the inner chambers are made in a similar corebox of suitable dimensions. The curved surface on the outer face of the core is imparted by a strike as shown at *A*.

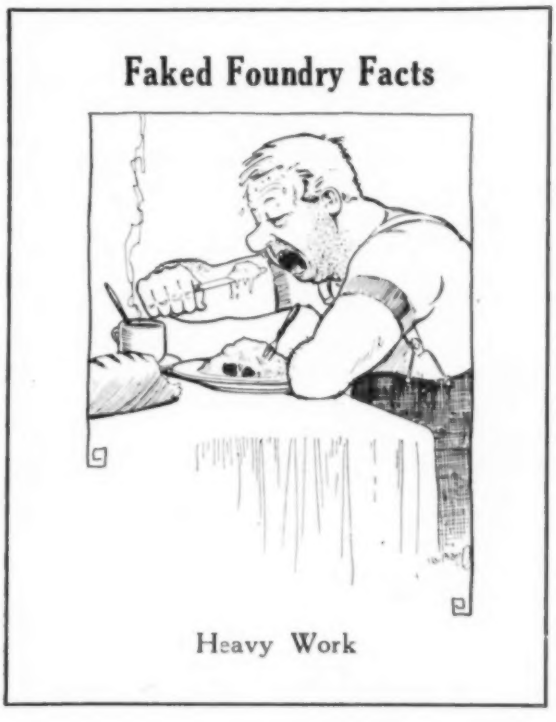
"Cores may be made from a good grade of open sand, bonded with any suitable binder. They may be reinforced either with cast-iron arbors or by individual 1-inch rods or pipes laid longitudinally, supplemented by ½-inch rods laid transversely. Two rows of each will be sufficient, four long rods in each row in the large cores and three long rods in each row in the small cores. The short transverse rods are spaced about 6 inches apart. Unless these cores are thoroughly vented the metal will not lie quietly against them and the upper flange of the casting will be honeycombed with gas bubbles. It is advisable to fill the center of the core with small coke and carry the vent through three openings in each end of the core. Suitable hooks are provided in the end for lifting the core vertically.

"Instead of a loam core, the center core may be made in halves and pasted. It is reinforced with long rods in each half and a 1½ or even a 2-inch channel is cut along the center for a vent opening before the halves are pasted together. After the two halves are pasted, the outside of the joint is scratched and then rubbed with slurry. Single strands of wire are wrapped tightly around the core about 2 feet apart to supplement the paste in holding the halves together.

"If a sufficient number of round flasks are available the entire mold may be made in the flasks. Where the crane head room is not equal to drawing the pattern or placing the cores, the mold may be assembled in a pit for pouring or it may be made and dried in a pit. The first flask ring is leveled on a plate and filled half way with coke. Sand is rammed to a depth of 1 inch over the coke and then scraped off to form a level bed for the reception of the core print on the lower or small end of the pattern. Additional rings are added to the flask and rammed full of sand around the pattern until the upper face on the upper flange of the flask is flush with the top of the upper flange on the pattern. A flat parting is made at this point and the pattern is drawn out of the sand. The mold is finished, blacked and dried and then the cores are lowered into place.

"The four outside cores are lowered first. They are followed by two inner cores. The center core is lowered next and when the two remaining inner cores are lowered, the set is complete. The outer cores are jammed hard against the outside of the continuous coreprint in the bottom of the mold. The distance piece on the side of each core regulates the thickness of metal in the wall between the chambers. Similarly, the distance piece on the curved face of the core locates the small core in front in its proper relative position. The distance piece on the inside curved face of each of the inner cores forms a print for locating the center core. The print on each core is lightly tipped with paste before it is lowered into place.

A stem chaplet anchored in the wall of the mold, or a stool chaplet suspended by a piece of wire will maintain the upper end of each outside core in its proper position in relation to the wall of the mold. The distance pieces on the



sides and on the inner curved face near the top of the core will hold it in correct position in relation to the cores on each side and the core in front. After all the cores are in place they may be wired together by the lifting hooks.

"After all the long cores are placed, a flat ring core in segments is laid around the top of the mold to cover the flange. The outer edge rests on the wall of the mold and the inner edge rests on a shoulder on the outside upright chamber cores. An empty iron cope is adjusted to cover the assembled cores. The mold is poured through 12 pop gates ½ x3 inches, evenly spaced on the four main vertical ribs of the casting. Four risers are taken off the outside of the upper flange, one in the vicinity of each of the four brackets. The casting should be poured with hot iron."

Making Semisteel Castings in France

OWING to its physical properties, semisteel was used extensively during the war for the manufacture of explosive shells. However, since then the use of semisteel has not developed to any large extent in France, except for the manufacture of rolls. In the opinion of J. Cury, vice president of the Association Technique de Fonderie de France, who read a paper on the subject recently in Paris, semisteel would be used to a larger extent for casting machine parts if its physical properties were better known and if uniform specifications relating to its use were drafted. He recalled that the subject already had been treated since the middle of the nineteenth century. In 1914, E. V. Ronceray published a complete treatise in French on the manufacture of semisteel shells.

Mr. Cury said that the carbon entering into the composition of semisteel should not be under 2.80 per cent with ¼ to 1/5 of this amount existing as combined carbon, to prevent lack of fluidity. The steel used to obtain semisteel should contain from 0.3 to 0.4 carbon and the following chemical analysis was given as an example: Carbon 0.35 to 0.45 per cent; silicon, 0.18 to 0.30 per cent; manganese 0.55 to 0.70 per cent; phosphorus, not over 0.04 per cent. Tentative specifications relating to the percentage of steel to be added in the furnace, which were stated to have been proposed in America, were given as follows: For light castings, add from 15 to 19 per cent of the total weight for medium castings, 20 to 29 per cent and for heavy castings from 30 to 40 per cent; the final product containing 3.20 to 2.80 per cent carbon and giving a tensile strength of 35,500 to 48,300 pounds per square inch. The temperature of the heat should be about 1450 degrees Cent.

The paper dealt especially with cupola practice since most of the semisteel castings used for machine parts are obtained by this process. According to the author, the height of the cupola should be equal to about six times the diameter of the hearth. The tuyeres should be rectangular, wide but with a small height, and spread out toward the inside of the cupola. The total section of the tuyeres should be one-quarter of the section of the cupola in the plane of the tuyeres, which corresponds to about 20 to 23 square inches for 220 pounds of castings per hour. The capacity of the cupolas generally varies from 2.5 to 4 tons per hour. The consumption of coke is greater than in ordinary cast iron practice. It is recommended to use a forehearth which previously has been brought to a red heat before the melting. Owing to the fact that the steel takes a certain time to melt, it is recommended to add about 10 per cent steel in excess and make ingots with the two first charges. These ingots can then be used in making up the burden for the next heats.

A good practice recommended for testing the grade of semisteel in the course of manufacture consists in casting small test pieces, one side of which is chill cast. The piece then is broken and the thickness of the tempered portion gives a good indication. With gray forge pig iron, this thickness is only about 0.079 inch whereas with semisteel it attains nearly one inch.

The following burden is considered as of average composition: Hematite pig iron, 40 per cent; semisteel ingots and scrap, 40 per cent; medium hard steel, 20 per cent. It is essential to remember that recarburization takes place in the cupola concurrently with loss of silicon and manganese. As a first approximation it is assumed that recarburation amounts to about 8 to 10 per cent while the loss of silicon and manganese is about 30 to 50 per cent. The correction is obtained by additions of ferroalloys. During the heat powdered aluminum is added to the extent of 1/10,000 of the weight of the product to be obtained, in order to prevent oxidation. Tapping is effected at a high temperature and solidification is rapid and the shrinkage is considerable, as much as 0.725 inch per yard. These facts should be borne in mind when casting pieces presenting various thickness.

The question of testing semisteel parts was discussed. At present the tensile test and the shock test are insisted upon. However, M. Cury hopes the brinell and the shearing tests will be adopted. The latter test can be effected on small bars 0.197 inch square which can be taken from the casting itself.

In the discussion which followed, E. Ronceray stated that in America as much as 2 per cent manganese was used, partly perhaps on account of its effect on sulphur. M. Ronceray also referred to the fact that at the international congress of foundrymen held last year in Paris, it was agreed that a test piece cast apart represents only the grade of the iron, and not that of the casting. He also insisted on the low cost of the Fremont test.

Answering a remark of M. Levy about the protuberances which appear where the casting presents a large mass, M. Cury said it was due to liquation. E. V. Ronceray pointed out that this fact is in favor of the superession of risers but it also might come from a bad ventilation of the core; M. Bruhl said that it came from lack of homogeneousness in the metal. M. Levy has observed this occurrence where oxidized scrap was used. A question was asked as to the maximum proportion of carbon and silicon which should not be exceeded. It was said at Birmingham in 1922, as much as 3 per cent silicon had been declared acceptable. According to J. Cury, the total percentage of carbon and silicon should not exceed 4.7 per cent; he was supported in this assertion by M. Levy.

India's iron and steel industry which has been developed during the last few years is making rapid strides. Large deposits of iron ore of excellent quality are found in India, as well as sufficient quantities of flux, and ample coal of fair thermal capacity. The natural advantages are partially offset, however, by the high cost of skilled foreign and consulting experts which must be brought in from abroad. During 1923 it is estimated that India's production of pig iron including ferro-alloys, amounted to 450,000 long tons.

Molding Motor End Brackets

Equipment and Methods Employed In Producing Standardized Work Which Is Typical of the Manner in Which Jobs of a Similar Nature Are Handled To Aid Production

MANUFACTURING companies are paying special attention to the standardization of their work in an endeavor to improve products, enlarge output, and lessen the cost of production. To attain these ends they are installing time and labor savings devices, and studying their correct application to give satisfactory mass production.

Molding machines are important time and labor saving devices and are a marked aid to mass production. The equipment used and methods employed in producing standardized work in the Westinghouse Electric & Mfg. Co. foundry at Cleveland, are typified in the making of electric motor end brackets. In this work the simplest methods have been adapted that will give accurate results and involving as few operations as possible. Two molding machines of different design made by the Osborn Mfg. Co., Cleveland, are used in making the molds. The drags are made on a direct-draw, rollover, jolt machine which is operated by compressed air.

The drag pattern plate is circular and made of aluminum. It is attached firmly to the cast-iron, rollover table which rests on the jolt table during the jolting operation. A suitable flask is placed around the pattern, four ram-up cores are set, the flask is filled with sand in the usual manner, and jolt rammed. The number of jolts given controls the density of the sand. On this the correct ramming was determined by actual tests. The mold then is butted off, the bottom board clamped in position, and the flask rolled over. A car is run under the elevated and inverted table of the machine in position to receive the mold. The car is equipped with a leveling device which adjusts itself to any unevenness of the pattern board. This is effected by a series of leveling pins which are depressed independently an amount necessary to level the mold. All these pins are locked by one lever. The clamps holding the flask and bottom board to the mold table then are released and the pattern drawn vertically upward leaving the finished drag mold on the leveling car. The drag mold then is lifted by the traveling crane and placed in position on the molding floor. After setting the center core the drag is ready to receive the cope mold.

The machine used to make the cope mold is a stripping plate, jolt type which is designed for handling deep draft copes. The pattern and plate for the cope also are made of aluminum. After the mold is made up, it is lifted away from the pattern by power applied at both ends of the plate. During the pattern drawing, the table of the machine moves upward at right angles to the surface of the pattern plate. The maximum variation from perpendicular, per inch of pattern drawn is 0.0005-inch. The jolt cylinder is controlled by an air-operated valve that has an adjustable fea-

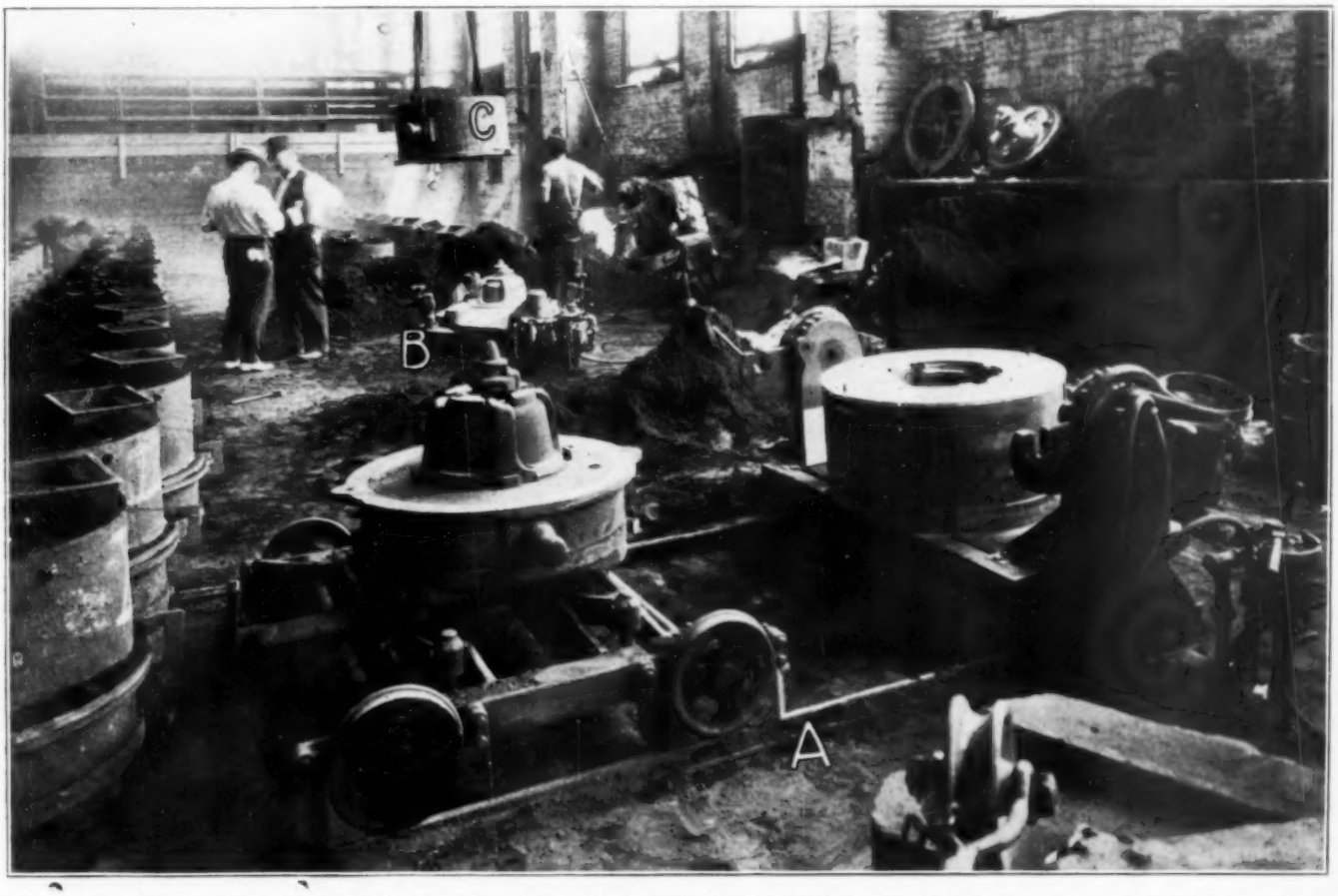


FIG. 1—MOLDING MACHINES WITH FLASKS AND EQUIPMENT USED IN MAKING COPE AND DRAG MOLDS FOR ELECTRIC MOTOR END BRACKETS

ture by which heavy or light blows may be applied at will by the operator.

Fig. 1 shows the two molding machines used in making the electric motor end brackets. The direct draw, rollover, jolt machine used to make the drag mold is shown at *A* and *B* is the stripping-plate jolt machine used to make the cope mold. Both cope and drag parts of the mold can be made on the rollover, jolt machine by changing the patterns, but to increase and facilitate production, and lessen costs, the two machines described are used together. At *C* is shown a cope mold suspended from the traveling crane by a rope sling attached to the trunnions of the cope flask. This cope is ready to be lowered on the drag. At the left are a

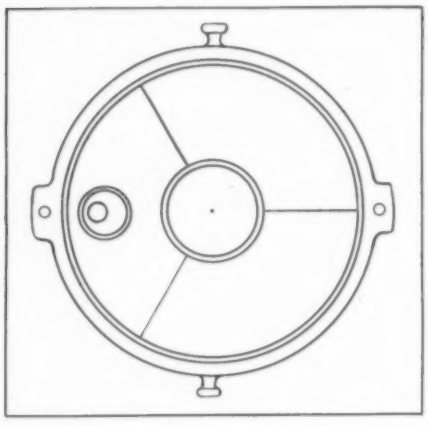


FIG. 2—TOP VIEW OF COPE FLASK, SHOWING RING AND BARS

number of assembled bracket molds ready for pouring.

The original flasks used on this job and shown in two rows in left of Fig. 1 are made of cast iron. As these are worn out or broken, they are replaced by steel, ribbed flasks made by the Truscon Steel Co., Youngstown, Ohio.

Fig. 2 shows the top view of a cope flask, indicating the location of trunnions, guide pin lugs and the center ring which is supported by three bars. These bars are used to hold the sand in position and resist the pressure of the liquid metal when entering the mold. Fig. 3 shows a horizontal section of the cope and drag molds joined, with the dry sand center core and ram-up core in position. The figure also shows the method of gating, runners used, etc. It will be noticed that no gaggers are used on this job. The steel flasks which are replacing the cast iron flasks shown are purchased according to the inside diameter and may be built up to accommodate different patterns by changing the position of the bars.

Fig. 4 shows the method of holding the bottom board to the drag flask and the wedge used. The bottom board is placed on the flask and a simple iron

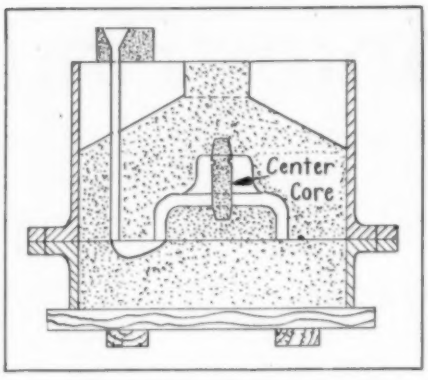


FIG. 3—VERTICAL SECTION OF COPE AND DRAG, WITH CORES AND SPRUE INDICATED

clamp is applied to one end, engaging a hole made in the flask. The other end is fitted under the bottom board. A simple wedge is driven between the bottom board and lower angle of the clamp. Two of these clamps are employed at opposite sides of the flask.

The Westinghouse Electric & Mfg. Co. has installed 10 of these machines. These include five direct-draw, rollover jolt machines and five stripping plate machines which are installed in pairs for cope and drag molds and constitute five standardized units covering three sizes, for small, medium and heavy work.

Three men work on one pair of molding machines producing medium castings. They make the molds, set the cores, clamp up, prepare running basins and pour off by the aid of crane ladles and produce on an average 80 molds a day.

On the small machines turning out the light work, two men work on one pair of machines and produce on an average 100 molds a day, the quantity depending on the amount of core work involved. They make the molds, carry out to floor, set cores, close and clamp, pour, dump and return flasks to the machine.

Rigging for Sash Weights

Question: We are contemplating adding a hard iron foundry to our present plant for making sash weights, elevator and counter weights and other hard iron castings. We have on hand a large quantity of steel scrap; structural steel, reinforcing steel, old boiler shells, flues, pipe and bands, also a considerable quantity of galvanized light sheets and pipe, low cast iron scrap, malleable iron and cast steel. What percentage of this material may we expect to use in these castings. What kind of flask and molding machine equipment is required for turning these castings out in large quantities. We shall appreciate your kindness in putting us in touch with manufacturers of foundry equipment.

Answer: An attempt to cover the ground outlined in your inquiry would far exceed the space at our disposal. For example in your second last sentence you write: "What kind of flask and molding machine equipment is required for turning these castings out in large quantities?"

We published a series of seven consecutive articles on this one phase of the subject in THE FOUNDRY commencing with the March 15 and closing with the June 15, 1924 number. Through any one of many reasons the articles may have escaped your attention, but you probably still have the copies in your files where you may refer to them.

Melting steel scrap exclusively or almost exclusively in the cupola involves many features not encountered in melting ordinary gray iron mixtures. Unless your melter is a practical man with considerable experience along this line, your

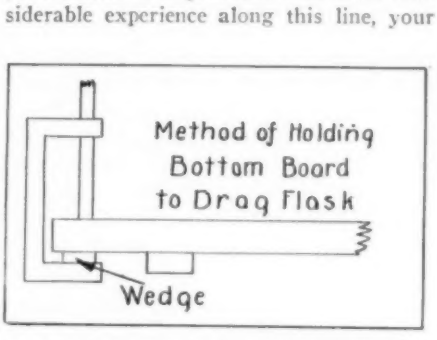


FIG. 4—SKETCH SHOWING METHOD OF HOLDING BOTTOM BOARD TO DRAG FLASK

early efforts will prove exceedingly discouraging. The most practical suggestion we can make is that you secure the services of an expert foundryman in a consulting capacity and retain him until your plant is functioning smoothly.

You can get in touch with a man of that kind through the advertising pages of THE FOUNDRY. The address of the manufacturers of foundry equipment may be had through the same medium.

Made Vice President

James A. Galligan, formerly with the By-Products Coke Corp., has been made vice president of the Mortimer B. Flynn Coal Co., 21 E. Van Buren street, Chicago. For several years Mr. Galligan was in charge of coke sales for Pickands, Brown & Co., Chicago, pig iron and coke dealers. He is a member of the coal and coke committee of the American Foundrymen's association.

Oscar R. Smith, formerly with the Pittsburgh Testing Laboratories, Pittsburgh, and later in charge of the laboratories of the Atlas Steel Corp., Dunkirk, N. Y., has become associated with W. B. Coleman & Co., Mulford building, Philadelphia.

How and Why in Brass Founding

By Charles Vickers

Magnesium as Hardener

We would like to know the properties of magnesium when added to aluminum alloys. Does this metal to a certain extent overcome shrinkage?

Magnesium can be used in the place of copper to harden aluminum alloys, and when used in about the same proportion as copper in the No. 12 alloy it produces a tough metal sometimes known as *magnalium*. However, this alloy is not easy to cast in sand molds. Used with copper in the proportion of one or two per cent, in aluminum alloys, magnesium strengthens and assists the machinability of the alloy. Thus an alloy of 2 per cent copper; 2 per cent magnesium; 96 per cent virgin aluminum, is good for many purposes. From 0.5 per cent to 2 per cent magnesium is frequently used with aluminum alloys.

Silicon is the element that overcomes shrinkage in aluminum alloys. Taking the No. 12 alloy as a standard, if some of the copper is replaced by silicon an alloy results that is more easy to cast.

Making Brass and Irons

We contemplate manufacturing polished brass and irons, and in making samples find the castings show fine holes, which do no harm to the casting, except that they prevent the proper finish being applied. We desire information in regard to filling these holes; whether there is a product on the market that can be used as a filler, using a torch if necessary to fuse the filler.

It is not possible to fill the holes in the castings as there is no filler that can be used on polished brass surfaces. It is necessary to make the castings free of all holes and blemishes in the first place as porous brass castings are never used. It may be that the melting methods are at fault. The copper, or brass should be melted in contact with charcoal when crucibles are used. Place charcoal in the crucible with the charge, and as it burns away during the melting period, more should be added so that when the metal becomes liquid, a layer of charcoal will be floating on top to protect it from atmospheric influences, that is the furnace atmosphere.

If the alloy is yellow brass, place needle vents on the high portions of the castings, and pour strongly enough to keep the sprues filled. Have the metal hot enough to give off fumes, but not so hot that the zinc crackles and gives off a brilliant white light. Two ounces of phosphor tin may be added to each hundred pounds metal with advantage in preventing porosity.

Pouring Temperature Affects Shrinkage

We desire to learn if castings of nonferrous metals shrink more when poured with cold metal. It appears that when gated properly the casting poured hot has a better chance to draw from the sprue or riser than it would be if poured cool. However, a contrary view is given that the cooler the metal when poured the less will be its expansion, therefore the shrinkage will be less.

When a metal is heated the cohesive attraction between the molecules is diminished, the force of repulsion is strengthened and when the two forces become equal the metal is a liquid. If the heating is continued the metal ultimately will become a gas, the force of cohesion having been further lessened or destroyed entirely. In this case the force of repulsion operates to drive the molecules further apart. The metal is expanded greatly at this latter stage and it follows that the higher the temperature the greater the expansion, as stated in the contrary view. No doubt it is possible to pour metal too hot into molds, but it also is possible that the metal may be poured too cool. The metal has to be sufficiently hot to be perfectly and completely fluid and if the metal contains zinc it must be hot enough for a certain amount to be volatilized and envelope the falling stream, thus excluding the atmosphere and preventing oxidation, otherwise, the castings will contain oxide films and will leak under slight pressures. Also as the metal was solidified before the feeding from the risers occurred, shrink cavities will be found. For example take an ordinary locomotive rod brass mold bearing down with all the casting in the cope. Put on a high head, and carry sprue to the mold joint, gating into each flange, and try the effect of cool and of hot pouring. The cool poured casting will shrink on the back at the junction of the flanges, but the hot poured one will be perfect provided, of course, nothing is wrong with either mold or metal.

Find Trouble in Making Brass Castings

We have experienced difficulty with yellow brass castings, samples of which we are sending you. The fractured surfaces of the castings show oxide inclusions in considerable amount. We use no scrap in our foundry; but use ingot, which runs approximately copper 68 per cent; zinc 30 per cent; lead 2 per cent. The samples are taken from a heat on which special care was bestowed in the preparation of sand, making of cores, heating of metal and pouring, and the results speak for themselves. We make nothing but yellow brass castings, and bronze alloys, no aluminum and the defects do not appear in the same kind of castings at regular intervals, but show up on different items.

The surface of the castings do not show aluminum, and there are no evidences of its presence in the fracture. Therefore, in this case we can eliminate this modern and almost ubiquitous trouble maker from consideration. The oxide can be seen in the castings; being a partly nonmetallic inclusion the continuity of the metal is broken and a little pressure forces gases and liquids through. The oxide may exist in the ingot metal, it can be formed while melting the ingot, or by pouring the metal at too low a temperature, by slow pouring, and by holding the pot or ladle at too great a height above the mold. If no blame can be attached to those melting and handling the metal in the foundry, then the ingot is at fault. To find the fault, have an analysis made of some of the defective castings, and compare with an analysis of the ingot before melting. Make your own analyses, and pay especial attention to the antimony content of the metal. Sometimes mistakes are made in making ingot metal, thus for yellow brass, it is a mistake to use scrap electrotype shells, as a source of copper as they make a brass high in antimony, and this latter element is bad in yellow metal. Also check the zinc content of the alloy for if it runs over 30 per cent it will cause trouble. Whatever may be found to be the source of the trouble. The use of a deoxidizer will improve the alloy. Use enough manganese copper to produce a pleasant brown color on the outside of the castings; probably 0.25 per cent will be a maximum.

Finish Patterns with Shellac

First Coats Are Sandpapered To Remove the Raised Grain—Various Colors Are Used To Distinguish Different Parts of Patterns—Wood Must Be Clean Before Shellacing

BY WALTER C. EWALT

SHELLAC is an important material employed by many industries of the world and used extensively by the patternmaker. The material is a resinous substance secreted by a scale insect named Coccus lacca, family of Coccidae, which lives on the twigs of various trees, especially the genus Ficus. The term *lac* means 100,000 and is indicative of the countless hosts of insects producing the substance. Only the female produces the lac, the secretion covering the body like a cocoon, from which the insect never escapes. As the formation continues, the insect develops principally into a large sac and a beak struck into the bark of the wood to extract the juices This sac contains the crimson fluid and is the substance forming the commerical lac dye.

This secretion in its natural state, incrusting the insect and small twigs, is called stick lac. When the stick lac is melted and reduced to a thin crust, it is called shellac. The insects, which are about 1/40-inch in length, are cultivated extensively, especially in Northern India. The world's output of shellac is about 400,000,000 pounds a year in the raw state, in which condition it is called gum. Crops of the gum are produced four times a year, namely in April, August, October and December.

Shellac is used widely in coating patterns. It is used to prevent the wood from absorbing moisture from the air and to prevent it from absorbing moisture from the sand when making a mold. Shellac makes and preserves a smooth surface on the patterns so that they may be drawn easily from the sand.

Impurities in shellac color it dark although the purest grade is a light orange. An adulterated shellac is one one mixed with ordinary resin. Alcohol holds the resin in solution, the shellac, being the hardest to dissolve precipitates downward. Therefore the part mixed with the resin will be used first. The resin causes the shellac to dry slowly and makes the patterns stick to the sand.

Patternmakers generally prefer to mix the shellac, buying the best grade of flake shellac and adding enough alcohol to cover the material. The shellac should be high grade, free from adulteration and when cut with highest denatured alcohol, of 188 proof, should produce a hard glossy finish. Original packages of shellac weigh 164 pounds.

The vessel in which the shellac and alcohol is mixed never should be made of metal as it will discolor the shellac. For mixing purposes, a wide open mouth bottle or earthen ware jar should be used. The cover may be made of leather or wood. A brush may be suspended through the center of the cover by boring a hole slightly larger than the brush handle. The brush may be held at first by a brad nailed tc the handle above the cover. In time the accumulation of shellac above the hole will cause it to be sufficiently small to hold the brush suspended. Enough shellac always should be kept in the bottle to cover the brush hairs. The brush should not be allowed to drop to the bottom of the container and remain there long as as the hairs will become permanently crooked.

Wood Must Be Cleaned

Before the pattern is shellaced it should be cleaned of sawdust and sand from the sand paper, either by brushing, wiping, or with an air hose A good brush should be used to apply the liquid. Brushes are made in various sizes, small round ones from 3/16 to 3/8-inch and flat sizes from ¼ to 1½-inch being obtainable in camel hair brushes. Good bristle brushes are made in sizes from ½ to 3½-inch. For 90 per cent of the work in the pattern-shop, the writer prefers a camel hair brush, flat and about ⅞-inch wide. Soaking a new brush in water or alcohol will prevent the hairs from coming out.

The first coat of shellac will raise the grain of the wood. This should be rubbed down with fine sand paper until the wood is smooth, care being taken not to rub more than is necessary. Another coat of shellac then is applied and rubbed down slightly and a third coat is applied. If good shellac is applied the pattern will be ready to rub in 30 minutes after the coat is applied. If the shellac remains stickey and refuses to dry properly, or if it curdles, the alcohol should be examined since such a condition usually is caused by a poor grade of alcohol. Three coats generally are applied, but if the pattern is to be used many times, six or seven coats of shellac may be applied in the manner described. It is considered better practice to use a number of coats of thin shellac rather than a few coats of heavy shellac. If the shellac turns a dark muddy color, it may be restored to its original brightness and luster by adding about 1/4 table spoon of powdered oxalic acid to a pint of shellac.

The patternmaker may estimate his needs by figuring that for the first coat of shellac, one gallon will cover 400 square feet, and for the second and subsequent coats, about 500 square feet. As yet the author does not know of any adopted standard by which patterns are finished in different colors. Most foundries require that different colors be applied to the body of the patterns and core prints and also that various colors be used to distinguish between different kinds of foundries. For example the gray iron foundry may have a black body and yellow core print, the steel foundry a red body and black core print, the brass foundry a yellow body and black core print and the malleable foundry a yellow body and red core print. An effort is being made toward standardization of colors for patterns together with other pattern-making practices by a subcommittee of the American Foundrymen's association headed by E. S. Carman, Osborn Mfg., Co., Cleveland.

Sometimes special removable pieces may be added to the pattern. These pieces may be varnished chrome yellow which may be made by mixing chrome powder with the shellac. This designates the part and cautions the molder not to mold this part without a specific order. A peculiar marking with different colors also is used on stop-offs. For example, cleats which have been put on the pattern to keep it straight sometimes are shellaced yellow with angle or cross hatch parallel lines of black, thus signifying to the molder that the impression in the sand made

by the stop off piece must be filled with sand.

Lamp black is used to color the sand black, while a dry analine black color, which is soluble in alcohol, may be used to give a glossy finish. Various red colors are obtained by using English vermilion, American vermilion, India vermilion, Egyptian red or Chinese vermilion. Prussian blue may be used for blue, but it makes a poor color.

The following illustrates the proper method of mixing the colors: The coloring material should be dry and ground fine. The coloring substance should be added to a small amount of shellac and worked to a paste, the alcohol and varnish then being added to the proper consistency. Shellac may be bleached by dissolving it in boiling lye or caustic potash and passing chlorine through the solution until all the resin is precipitated. The product is known as white shellac.

If a small piece of wood is to be turned on a face plate, the wood may be attached to the face plate with shellac. To prepare shellac for this purpose two handfuls of flake shellac are placed in a cloth, which is wrapped and placed in hot water for a few minutes. When the shellac is soft it is taken out of the water and shaped in the form of a long round stick by rolling on a board or between the hands. After the cloth is removed, the stick is held against the revolving face plate. Enough heat is generated so that the face plate will receive a coat of shellac. The wood to be turned then is held against the revolving face plate which has been coated with shellac and at the instant the shellac is melted, the lathe is stopped. The shellac hardens, binding the piece of wood to the face plate. This operation will require some practice to obtain good results, but it will make a joint strong enough to hold small pieces and the work easily is taken off the face plate by inserting a chisel along the joint. Two handfuls of shellac will make a stick of convenient size, about 4 inches long and one inch in diameter. A jar of heavy shellac may be kept for sticking wood or paper to iron.

Shellac also is used to fill screw and nail holes when something harder than beeswax is required. This is done by placing a piece of flake shellac on the end of a scraper made from an old hack saw blade and holding it over an alcohol lamp until melted and then ramming into the hole.

Efficient ventilation changes the air in the foundry completely every 6 seconds.

Pipe Standardization Is Progressing

Rapid and important progress is being made by the sectional committee on pipe flanges and fittings which is working under the procedure of the American Engineering Standards committee and under the joint sponsorship of the American Society of Mechanical Engineers. Manufacturers Standardization Society of Valve and Fitting Industry, and Heating and Piping Contractors National association.

The 1914 A. S. M. E. standard for cast-iron flanged pipe and fittings for 125 pounds steam pressure is now undergoing vote of the sectional committee. While the present specification involves a number of changes, it does not differ in its broad outlines from the earlier form. One of the most important changes is the elimination of approximately 50 per cent of the sizes above 10 inches in diameter. The older size series provided an unnecessarily close spacing of diameters.

Produce Centrifugally Cast Tubing

The Centricast Tube Corp., 61 Broadway, New York, which recently increased its capitalization from $65,000 to $80,000, took this action in connection with its activities in the producton of centrifugally cast, seamless, monel tubing. The company now is producing this tubing at the plant of the Wm. J. Sweet Co., Philadelphia. The Sweet company now is building a larger plant at Hillside, Newark, N. J., into which it will move this winter, and the Centricast Tube Corp. then will produce monel tubing at this new plant on a larger scale. The monel metal, by this process, first is cast into hollow billets, which then are cold drawn into tubing. For the present, this tubing will be produced only in iron pipe sizes. Leon Cammen is president of the Centricast Tube Corp. and F. E. Hamilton is secretary.

To Print Standards

Plans are now on foot for printing in draft form all proposed standards on the program of the sectional committee working under the procedure of the American Engineering Standards committee. These proposed standards will include malleable and cast iron screwed fittings for 150 pounds square inch working steam pressure; cast-steel flange standards up to 3200 pounds working steam pressure; cast-iron flange standard for 150 pounds working steam pressure, and cast iron screwed and flanged long turn sprinkler fittings. Ammonia fittings screwed and flanged, screwed steel fittings, and screwed nonferrous fittings also are included. Such a draft form will give a general idea of the importance and scope of the program before the sectional committee which contains 62 members and represents 30 organizations.

Plants Are Consolidated

The Chas B. Bohn Foundry Co., and the General Aluminum & Brass Mfg. Co., Detroit, have been consolidated. The Bohn foundry company was organized a few years ago by C. B. Bohn, former resident manager of the Detroit branch of the Aluminum Co. of America. After leaving that company he started his own business of making aluminum castings for the automobile trade as well as brass fixings and other automobile hardware.

Officers Are Elected

Leonard Peckett has been appointed president of the Warren Foundry & Pipe Co., Phillipsburg, N. J., recently noted as acquired by the Replogle Steel Co., 120 Broadway, New York. W. H. Hulick, former president of the Warren company, will serve as vice president and A. L. Reiley, also of the Warren organization, will continue as secretary. L. R. Dohn, of the Replogle company, has been appointed treasurer. The duties of this position were formerly handled by Mr. Hulick, who was assisted by A. D. Chidsey, vice president. Mr. Hulick and Chester Snyder, of the old directorate, will remain on the board. The new members, all of the Replogle organization, are as follows: J. Leonard Replogle, Leonard Peckett, William Keer, L. P. Ross, and W. S. Pillings. They succeed Edward J. Fox, W. H. Walters, Lee Clymer, Clayton Hackett, and A. D. Chidsey.

The Warren company will retain its name, and will be managed along the same lines as heretofore. J. H. Morrison will remain as general sales manager. While it is planned to consolidate the two executive offices, which are in New York, the permanent address has not as yet been decided upon. As stated in a previous issue, the chief aim of the Replogle interests in purchasing the Warren plant was to provide steady outlet for a substantial portion of their pig iron production. The capacity of the Warren plant is around 8000 tons a month, and for a considerable time has been operating close to this capacity.

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Common Sense Still at Premium

PROMINENT among those who are inclined to claim that scientific management is a failure and among others who bluntly declare their entire disapproval of the system in whole or in part, are the men who have been inclined to look upon the various developments of scientific management as substitutes for the attributes or virtues at one time known under the plain homely appelations of business ability, shrewdness or the trading instinct. They make the somewhat natural mistake of assuming that the system is a panacea in itself, something automatic that may be secured in yard lengths to suit any plant and something, that once installed, will require no further attention. Basing their opinion either on idle hearsay or upon fragmentary items on the subject engaging their attention from time to time, they assume that the system in some mysterious manner will eliminate all hazard incident to the presence of the human factor in industry.

A natural trading instinct, the ability to compare values either in money, commodities or time, together with a gift for gaging the future with a reasonable degree of accuracy, all these were regarded as a necessary part of the mental equipment of a man who proposed entering business at any time previous to the period when F. W. Taylor at the Midvale steel plant in Philadelphia conceived the system which bears his name. Although some people refuse to recognize the fact, the same mental equipment is necessary today despite the many offshoots and developments of the Taylor plan that have come into existence since its first inception.

For many years executives have been making use of reports and charts and the many forms devoted to cost accounting, production planning, time study, and wage payment systems. In the great majority of cases these various aids have been employed in the manner for which they were intended, merely as a means to an end. Tools, one might say by which certain work is accomplished. In general they were regarded as time and labor saving pieces of equipment and therefore as much a part of the modern office as the typewriter or the comptometer. Among the class of people referred to at the beginning, these methods were grasped with an almost childish belief that they would solve all business troubles, that a certain system would substitute for trained business judgment and that the simple installation of a system would insure success.

Of course such a belief is preposterous. In many instances the man with natural business ability who adopted the new methods attained a greater measure of success, but he used the system as a tool and not as a crutch. A cost system will indicate the manner in which greater profits may be secured; a production planning system will save time material and labor and in that manner will reduce costs; but they will produce these results only when they are employed by an otherwise capable man. The man must have a thorough and intimate grasp of his business in its varying ramifications and apply any system intelligently to secure the results he desires.

Methods involved in carrying out any of the phases of scientific management are not substitutes for brains or hard work, or for the exercise of ordinary common sense. They merely are auxilliaries and have proved of distinct advantage when employed in that capacity . They will not run the business by themselves while the owner is away on the golf links or engaged in building castles in Spain.

Trade Outlook in the Foundry Industry

DEFINITE indications of an upturn in foundry activities are noted in the early part of September. Orders for castings in many cases have increased to the point where iron contracts are being made for the remainder of the year, although throughout the summer, purchases have been made on a hand-to-mouth basis. Machine tool prospects are brighter than at any time in the past six months. Municipal jobbing castings remain exceedingly active, despite the approach of winter inactivity. Railroads are inquiring for more equipment and heavy orders are expected within a few weeks. Automobile shops are increasing production.

Boom Not Expected

Statistics measuring July activity in various lines of manufacture continue to bear out the statement made on this page early in August, namely that the low point had been passed and that recovery would follow through the fall with a satisfactory development in new business. However, no period of exceptional prosperity nor of strenuous production is expected. The majority of foundries anticipate a fair volume of business, with increasing orders for castings through the remainder of the year. Stocks of castings in many lines have been lowered, so that the normal demand for current consumption will be supported by some need for accumulation. This particularly is true among the pipe foundries, where the demand has been sufficient to absorb output an where an unusual fall buying movement promises continued capacity operation throughout the winter. Building construction is going ahead steadily, the department of commerce reporting contracts let in 36 states to show an increase of 10 per cent in July. Further, the first six months of this year registered a gain of 10 per cent over a similar period in 1923.

Rebound Noted

The influence upon sanitary ware production is apparent and orders for this class of castings again are building up. The department of commerce reports a total of 67,770 orders for bath tubs received in July, against 67,404 in June, while lavatories, sinks and miscellaneous castings showed even greater gains, in some cases closely approaching the totals of orders shipped for July. Jobbing foundries have felt the influence of this sustained activity in construction lines and the upturn following July has been quickly apparent. In Indiana and Illinois, operations have increased probably to 60 to 75 per cent of normal. In Ohio, according to the Ohio State Foundrymens association, the actual melt for July stood at 62.5 per cent of capacity, compared to 72 per cent in June. Individual instances indicate that August will show a marked betterment. Stocks of iron on hand stood at 87 per cent in June and had declined to 85 per cent in July. In the New England territory, foundry operations are on the mend. An investigation among a number of foundries in the vicinity of Boston showed that in every case increased orders and inquiries prevail.

Rail Outlook Improves

The number of idle railway cars steadily is declining, starting with July. At one time the surplus amounted to 370,000 cars and this dropped to 296,000 early in August. Further, loadings are mounting, the week ending Aug. 23 showing a total of 982,248 cars loaded, an increase of 29,360 cars over the preceding week. Coal and grain movements are underway and with the increased demands upon both rolling stock and motive power, renewed railway purchases are expected. Unfilled orders for locomotives have declined, reaching a low point in August. Malleable castings orders were at a low point in July, according to the department of commerce. During that month, 132 plants reported a total of 29,660 tons booked, against a potential capacity of 108,055 tons, giving a rate of 28.5 per cent operation. The previous month showed 31.2 per cent and March, which was the peak for the current year, 66.5 per cent. Improved conditions in the automobile manufacturing industries already has made a change, apparent in the operating rate of some of the larger institutions making malleable castings. Blast furnace operation again has started upward, August showing a gain of 5 per cent over July, according to statistics compiled by the *Iron Trade Review*. The total output of pig iron last month was 1,874,920 tons, compared to 1,783,457 for July. The total of merchant iron produced in August was 453,870 tons, compared with 468,780 tons for the preceding month. On a daily average basis, the decline in merchant iron production also is apparent, having dropped from 15,122 tons in July to 14,641 tons.

Prices for Raw Materials for Foundry Use

CORRECTED TO SEPT. 6

Iron		Scrap	
No. 2 foundry, Valley	$19.50 to 20.00	Heavy melting steel, Valley	$18.25 to 18.50
No. 2 southern, Birmingham	17.50 to 18.50	Heavy melting steel, Pitts.	17.50 to 18.00
No. 2 foundry, Chicago	20.50	Heavy melting steel, Chicago	16.50 to 17.00
No. 2 foundry, Philadelphia	21.26	Stove plate, Chicago	16.50 to 17.00
No. 2 foundry, Buffalo	19.00 to 19.50	No. 1 cast, Chicago	20.50 to 21.00
Basic, Valley	19.00 to 19.50	No. 1 cast, Philadelphia	18.00 to 19.00
Basic, Buffalo	19.00	No. 1 cast, Birmingham	15.00 to 16.00
Malleable, Chicago	20.50	No. 1 cast, Buffalo	17.00 to 17.50
Malleable, Buffalo	19.00 to 19.50	Car wheels, iron, Pittsburgh	17.50 to 18.00
Coke		Car wheels, iron, Chicago	18.25 to 18.75
Connellsville foundry, coke	$4.00 to 4.60	Railroad malleable, Chicago	18.00 to 18.50
Wise County foundry, coke	4.50 to 5.00	Agricultural mal., Chicago	17.50 to 18.00
		Malleable, Buffalo	17.50 to 18.00

Nonferrous Prices

Prices on nonferrous metals according to New York quotations in the *Daily Metal Trade* of Sept. 6, follow: Casting copper, 13.12½c; electrolytic copper, 13.25c to 13.30c; Straits tin, 52.25c to 52.37½c; lead, 8.00c to 8.15c; antimony, 10.75c; nickel, 31.00c; aluminum No. 12 alloy, remelt, 21.00c to 21.50c. Zinc is 6.25c, E. St. Louis, Ill. Average monthly prices for August follow:

New York Prices

Castings Copper	Electrolytic Copper	Lead	Tin Straits	Antimony	Aluminum 98-99	Zinc St. Louis
13.13	13.511	8.02	52.342	9.62	26.97	6.179

Personal

Robert Ronceray Jr., son of E. Ronceray, director of the Ecole Superieure de Fonderie de France, French School for Foundry Engineers, sailed Aug. 21 for the United States where he intends to spend several weeks in Detroit to study American foundry practice. He also is prepared to discuss the processes of machine molding and of making pattern plates used in the works of Ph. Bonvillain & E. Ronceray, Choisy-le-Roi, near Paris. Mr. Ronceray Jr., was formerly connected with W. & T. Avery, Ltd, Soho Foundry, near Birmingham, England. He will attend the convention of the American Foundrymen's association in Milwaukee, Oct. 11 to 16.

Clarence Mott Woolley, president of the American Radiator Co. has accepted the appointment as one of the arbiters for future disputes under the Dawes plan. Mr. Woolley is expected to have charge of arbitration on money transfers and other questions.

J. Frank Lanning of the J. Frank Lanning Co., Pittsburgh, is scheduled to be the speaker at the opening meeting of the 1924-25 season of the Pittsburgh Foundrymen's association. Mr. Lanning will talk on "Some of the High Places I Have Hit" and the talk will be illustrated by motion pictures. The meeting will be held Monday evening, Sept. 15, at 6:30 p.m., at the General Forbes hotel, Pittsburgh.

Offices Are Moved

W. B. Coleman & Co., metallurgists, chemists and engineers, have removed their offices to the Mulford building, fifteenth and Wallace streets, Philadelphia. The company operates completely equipped laboratories for analysis and testing of metallurgical materials and also engages in consulting work in metalworking lines.

Of the 74 establishments engaged in the production of cast iron pipe and fittings reporting to the department of commerce for 1923, 33 were located in Alabama, 9 each in New Jersey and Pennsylvania, and the remaining 23 in California, Colorado, Indiana, Maryland, New York, North Carolina Ohio, Oregon, Tennessee, and Virginia.

The department of commerce announces that according to reports for the biennial census of manufactures, 1923, the establishments engaged primarily in the manufacture of cast iron pipe and fittings in that year reported such products valued at $87,443,039 together with other classes of products valued at $5,231,049 making a total of $92,674,088. The increase in the total value of products as compared with 1921, the last preceding census year was 109.1 per cent.

Charles A. Klump Dead

Charles A. Klump, one of the pioneers in the malleable iron industry, died Friday, Aug. 29, 1924, at his home, 1890 E. 89th St., Cleveland. Mr. Klump was born in Essen, Darmstadt, Germany, in 1843. He migrated to this country in 1852, and spent his early years in the state of

CHARLES A. KLUMP

Connecticut. At the age of 25 he came to Cleveland, and became the first superintendent and afterward general manager of the Cleveland Malleable Iron Co., the parent company of the present National Malleable Iron & Steel Castings Co. Mr. Klump held the position of general manager for a number of years and was a director of this company at the time of his death.

As a pioneer in malleables Mr. Klump saw this industry grow from a small beginning, when the secrets of the art were held by the few, to its present enormous proportions, when chemistry, metallurgy and standardized methods in molding have become the controlling factors.

Mr. Klump is survived by his widow, Mrs. Adeline C. Klump; three sons, Charles H., W. H., and Frank M.; two daughters, Mrs. Minnie McDonald and Mrs. Justine Griess, all residing in Cleveland.

Core Arbors for Small Pipe Castings

Question: Will you kindly tell me how the green sand cores for 2-inch rain water spouts are made. I understand they are made in green sand and would like to know the shape of the core iron if the core is made in a box.

Answer: We have no personal knowledge of sand or conditions in the British Isles, but we have been told by reliable foundrymen that a solid core iron in the shape of a 1-inch square bar is employed in small rain water spouting. In this country castings of that kind are not used on the houses. The nearest approach we have to them is in the shape of soil pipe castings made in standard 5-foot lengths, 2 to 6 inches in diameter and ¼ to 7/16 inch thickness of metal in the wall.

Cast iron pipe arbors are employed on the larger sizes, but on the 2-inch size a section of steel pipe classed as extra heavy is converted into an arbor. The pipe is pierced for vent holes and the total number of vent holes will depend on the quality of the sand employed in any given foundry where castings of this character are made. The arbor is laid horizontally on two bearings where sand is allowed to fall upon it from an elevated hopper. A rigid straight edge extending from one bearing to the other, cuts away the superfluous sand and shapes the core to the desired size. If you have access to back files of THE FOUNDRY either in your city public library or elsewhere we suggest that you look up articles on the subject in the following numbers: Aug. 1, 1919; Jan. 15, 1921; Dec. 15, 1922.

Obituary

W. G. Stevenson, president and general manager of the Stevenson Co., Wellsville, O., manufacturer of brick, sewer pipe, tile and reduction machinery, died at his home in Chicago, Aug. 21, aged 56 years. Owing to ill health, Mr. Stevenson had not been active in the business for the past two years.

Henry J. Wanner, chairman of the board of the Wanner Malleable Castings Co., died at his home, 5442 Hyde Park boulevard, Chicago, Aug. 18. The Wanner company has plants at Hammond, Ind., and Beloit, Wis. Mr. Wanner is survived by Mrs. Wanner and a son, Harry C. Wanner, who is president of the Wanner company.

F. J. Koch, general manager, Vacuum Ash & Soot Conveyor Co., Wilson avenue, Newark, N. J., is interested in white iron castings.

Simplification of Manhole Frames and Covers

Foundrymen, municipal engineers and service departments, public utility companies and manufacturers are to be invited to a conference at an early date in Washington, D. C., by the simplified practice division of the department of commerce to consider recommendations to reduce the present great diversity in sizes and dimensions of manhole frames and covers for street use.

Communications have ben addressed to the American Foundrymen's association, the Water Works Manufacturers' association, the International association of Street Sanitation officials, the American Society of Civil Engineers, the American Gas association, the Associated General Contractors, the American Electric Railway association, the National Electric Light association, the American Railway association and a large number of municipalities and public utility companies.

The simplification plan for manhole castings was suggested last March to the Hoover committee on elimination of waste in industry by the Industrial Association of San Francisco, through its consulting engineer, H. K. Hathaway, formerly of the Tabor Mfg. Co., of Philadelphia, and an associate of the late Frederick W. Taylor, who has been called the *father of scientific management*. It is pointed out that as localities in various parts of the country use widely diversified assortments of sizes, it is difficult for foundries to do more than a *local* business in these products. Interest was shown in all of the replies received by the simplified practice division, and co-operation was promised in the movement.

The American Foundrymen's association replied as follows: "Our diversified membership makes it difficult to say which of our members will be most interested in this project. We published a statement on the simplification of cast iron manhole tops and covers in our April, 1924, *Bulletin*, and suggested interested readers write directly to your division. The association desires to co-operate in work of this kind as far as it is consistent to do so."

The Water Works Manufacturers' association suggests that the simplified practice division write individual members for their views and suggestions, and states that although manhole castings are not a large part of the members' business, the members of the association would be glad to follow the lead of the larger manufacturers. Relative to a simplification of cast iron manhole covers, the association says, it would be pleased to attend a preliminary conference on the subject and expresses endorsement of the proposal.

Among the city engineers, utility companies and municipal departments in various cities making replies are the following: Birmingham, Ala., New Orleans, New York City, Atlanta, Buffalo, Cincinnati, Salt Lake City, Portland, Oreg., city and county of San Francisco, San Diego, Calif., Los Angeles, Seattle, Spokane, Denver, St. Louis, Minneapolis, Duluth, Milwaukee, Chicago, Cleveland, Philadelphia, Baltimore, Washington, Richmond, Va., Jacksonville, Fla., and the American Telephone & Telegraph Co., New York.

Plant Nearing Completion

The new plant of the Bridgeport Safety Emery Wheel Co., Bridgeport, Conn., is nearing completion. The company will have about double the floor space and approximately three times the former capacity for the manufacture of floor, shear, knife and face grinders and wheels.

Interested in Castings

John Oster Mfg. Co., 3134 Osborne boulevard, Racine, Wis., is interested in a large quantity of small gray iron and malleable castings weighing from 1¼ to 3 ounces each.

Elected Vice President

Gordon H. McCrae, manager of the London, England, office of the Independent Pneumatic Tool Co., Chicago, recently was elected vice president of that company. At present Mr. McCrae is visiting in this country.

Foundry Incorporated

The W. H. Knowles Foundry & Machine Co., Ottawa, Ill., recently was incorporated under the name of the Knowles Foundry & Machine Co.

Tariff Is Levied

The steel industry of India cannot produce under competitive conditions except the commoner types of steel and iron and the Indian government has levied a tariff on certain iron and steel imports which is expected to enable the industry to develop along broader lines.

The general offices of William Swindell & Bros. have been moved to the new office building, Freeport road near Aspinwall, Pa., post office box 1753, Pittsburgh.

The new Baltimore plant of the Porcelain Enamel & Mfg. Co., now is in full operation.

Ohio State Foundrymen Meet In Cleveland

Cleveland has been selected for the fourth annual convention of the Ohio State Foundrymen's association to be held on Sept. 18 and 19. The program on this occasion is unusually extensive and embraces many entertaining and social attractions in addition to the regular business features. Commencing with a luncheon at 12 noon in the hotel Cleveland the program for the remainder of the day includes an address of welcome by Clayton C. Townes, mayor of Cleveland to be followed by addresses on *Industrial Liberty and Its Responsibility*, Walter Gordon, Merritt League for Industrial Rights, New York; *The Open Shop*, William H. Barr, president National Founders association; *Various Foundry Cost Methods, Correct and Incorrect*, E. T. Runge, E. T. Runge Cost Co., Cleveland; *Why the Ohio State Foundrymen's association?* C. C. Smith, Toledo Steel Casting Co., Toledo, O. An informal banquet will be tendered the visiting foundrymen in the ball room of the Cleveland hotel in the evening followed by an entertainment program sponsored by the local members.

The forenoon on Friday will be devoted to a sight seeing trip including a visit to the research laboratories, lamp division of the General Electric Co., Nela Park. In the afternoon papers will be presented on *Simplified Practice—A Profit Making Policy*, R. M. Hudson chief, division of simplified practice, department of commerce, Washington; *Reducing Production Costs*, E. S. Carman, Osborn Mfg. Co., Cleveland. W. L. Seelbach, Walworth Run Foundry Co., is general chairman and will be assisted by Ralph West, West Steel Castings Co., chairman reception committee; William Greenbaum, Acme-Palmers & DeMooy Foundry Co., chairman entertainment committee; B. R. Pearse, Atlas Foundry Co., chairman transportation committee; Charles Seelbach, Forest City Foundry & Mfg. Co., chairman golf committee.

Capacity Is Estimated

Authoritative estimates of the combined capacity of the 14 soil pipe plants, recently noted as merged under the name of the Alabama Pipe Co., place the total at 85,000 tons annually. The yearly output controlled by the Gulf States Pipe Corp., recently organized as the selling agency for several southern concerns, is stated to be approximately 65,000 tons.

The Sulfex Corp., has moved to larger quarters at 81 New street, New York, Frederick Conklin is manager.

Increased Demand Continues

Manufacturers of Foundry Equipment Are Finding a Slightly Better Sale for Their Products—Inquiries Are Increasing and Some Old Lists Are Being Revived

INCREASED demand for foundry equipment is noted in practically all distributing centers throughout the country, the exception being in the Pittsburgh territory where no marked improvement is found. Inquiries have increased considerably during the past month and many dealers report that foundrymen are considering lists which have been out for some time. A fair amount of new foundry construction is being planned, which should call for some substantial orders for machines and other equipment in the future. Manufacturers of equipment feel that the increase in foundry operations will be reflected soon in a satisfactory volume of business. Much interest has been noted of late in sand-blast equipment, numerous sales being made by the Pangborn Corp., Hagerstown, Md., and the W. W. Sly Mfg. Co., Cleveland. The National Engineering Co., Chicago, has placed its sand mixers in a number of plants and is receiving inquiries on a new sand aerating machine which it is distributing. The demand for foundry cranes is light.

More New Construction Is Appearing

WHILE there are dissenting opinions, foundry equipment sellers generally are agreed that the first two weeks in September have brought an improvement in demand in the eastern district. More new construction is reaching an active stage, and operations at various jobbing foundries have improved. Sellers handling an assortment of foundry equipment state that there appears to be a particular interest in sand blasting units. One large house is understood to have sold more in one week recently than in the preceding three weeks combined. Orders now being placed for equipment for the Maryland state penitentiary, Baltimore, include a dust arrester. The Newport News Shipbuilding & Dry Dock Co. noted in a previous issue as having purchased a sand cutter and some heavy ladles for its plant at Newport News, Va., is figuring on some used equipment, although it is understood that it has just purchased or is about to purchase a new sand blast unit. The Vulcan Iron Works plant of the Eastern Malleable Iron Co., New Britain, Conn., is figuring on a new 3-story, 80 x 100-foot addition, and will require among other miscellaneous equipment, an annealing unit and a 5-ton electric crane. The Rhode Island Malleable Iron Co., Providence, R. I., has placed a contract with the C. I. Bigney Construction Co. for the erection of a $60,000 foundry, for which equipment still is to be purchased. Henry Donohue, Yonkers, N. Y., previously noted as having purchased a 76-inch cupola and other miscellaneous equipment for a new sashweight foundry, is understood to be negotiating for some light conveying equipment. A. Weiskittel & Sons, Baltimore, has purchased an additional dust arrester installation from the Pangborn Corp., Hagerstown, Md., while the Ross-Meehan Foundries, Chattanooga, Tenn., has secured a sand blast and dust arrester installation and the Philips & Clark Stove Co., Geneva, N. Y., has purchased sand-blast equipment from the same manufacturer.

Inquiries Are Heavier

INQUIRY being received by manufacturers of foundry equipment in the Chicago district has increased considerably in the past two weeks and with improved business apparently just in the offing, many foundries are modernizing their methods. For a few weeks the malleable iron foundries appear to have been in a better position than the steel and gray iron ones, but now the latter two have moved up to a parity with malleable. The National Engineering Co., Chicago, has just placed its sand mixers in the plants of the Old Dominion Iron & Steel Co., Richmond, Va.; Chapman Valve Mfg. Co., Indian Orchard, Mass.; T. H. Symington Co., Rochester, N. Y.; Newport News Shipbuilding & Dry Dock Co., Newport News, Va., and the Croix works of the International Harvester Co. in France. The National Engineering Co. also is receiving numerous inquiries concerning a new sand aerating machine which it is putting on the market. The Pangborn Corp., Hagerstown, Md., has sold sand-blast and dust arrester equipment to the American Car & Foundry Co., Detroit, and sand-blast equipment to the Denver Rock Drill Mfg. Co., Denver; the Holmes Foundry Co., Port Huron, Mich., and the Becker Mfg. Co., Two Rivers, Wis. The South Side Malleable Castings Co., Milwaukee, has purchased tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland, and the Packard Motor Car Co., Detroit, has secured dust arrester equipment from the same manufacturer.

Sales Increase Slightly

SLIGHT improvement continues in the foundry equipment market in the Cleveland territory, although the gain during the last two weeks is not as marked as that reported for the previous two weeks. However, with practically all vacations over, and general conditions in the foundry industry continuing to improve, manufacturers of equipment field that a real buying movement will start soon. Inquiries are good, and users of machines are in some cases reviving lists that have been pending for some time. Several dealers have received telephone orders for equipment during the past week. Considerable repair work is being done in plants in this territory and it is reported that pattern shops are working at a good rate. The Modern Foundry Co., Cincinnati, has purchased four large mold drying ovens from the F. A. Coleman Co., Cleveland. The Crane Co., Chattanooga, Tenn., has secured eight sand-blast cleaning rooms from the W. W. Sly Mfg. Co., Cleveland. Other purchases of equipment from the Sly company included the Buckeye Steel Castings Co., Columbus, O., which secured a sand-blast room for cleaning railroad castings, the Falcon Bronze Co., Youngstown, O., which purchased a tilted blast mill of the positive pressure type and dust arrester equipment, the Ross-Meehan Foundries, Chattanooga, Tenn., which bought a tilted blast mill of the positive pressure type, and the Dunham Co., Berea, O., which purchased blast pressure tanks. The Buckeye Steel Castings Co. also purchased dust arrester equipment and the American Radiator Co., Buffalo, secured tumbling mill

equipment from the W. W. Sly Mfg. Co.

Sales Are Light

CONSIDERABLE sales resistance is being encountered in connection with foundry equipment in the Pittsburgh area and while selling is not at an absolute standstill it is perhaps as quiet as it has been at any time in the past two months. However, sellers generally hope and believe that this is the lull before the storm. New inquiries coming out as well as old ones being revived promise a fair measure of buying for early Fall. Included in the list of recent purchasers is the United States Cast Iron Pipe & Foundry Co., Scottdale, Pa., which placed an order for sand mixing equipment with a local dealer. The Duquesnes Steel Foundry Co., Coraopolis, Pa., bought flask pins and the Mesta Machine Co., Homestead, Pa., ordered repairs to sand mixers while several foundries in this district have been ordering steel cupola charging cans. Among recent purchasers of molding machine equipment from the Herman Pneumatic Machine Co., Zelienople, Pa., is the General Electric Co., Lynn. Mass., and the Bonney-Floyd Co., Columbus, O., each taking one large rollover machine. Numerous molding machines inquiries are pending here and this manufacturer is much encouraged over the outlook for better and bigger business within the next month or six weeks. Small supplies continue to be sold as needed and a few sales of riddles, flasks, shovels, wheelbarrows, etc., are noted from time to time. The J. P. Ward Foundry Co., Blossburg, Pa., is said to be in the market for machinery to equip a plant for the manufacture of pipe fittings. The Frazer & Jones Co., Syracuse, N. Y., and the Erie Stove & Mfg. Co., Erie, Pa., bought tumbling mills from the W. W. Sly Mfg. Co., Cleveland. The Sly company also has sold blast pressure tanks to the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The Reading Foundry & Supply Co., Reading, Pa., will purchase some additional equipment for the plant it is rebuilding which was damaged by fire late in July. The J. W. Pohlman Foundry Co., Buffalo, is purchasing a small amount of equipment for a foundry addition it is erecting and E. G. Munson, Utica, N. Y., has awarded a contract for a one-story foundry for the production of iron and steel castings. So far as can be learned, equipment has not as yet been purchased. The Pawling & Harnischfeger Co., Milwaukee, has sold two 5-ton cranes to the Lunkenheimer Co., Cincinnati, and one 15-ton crane to the Modern Foundry Co., Cincinnati.

Slight Improvement Noted

A SLIGHT improvement in inquiry for foundry equipment has been noticeable in New England recently. Foundry production still is at a low point and nothing startling in the way of sales is expected until the fall season has progressed further. Most equipment dealers report no sales whatever during the past two weeks. The H. B. Smith Co., Westfield, Mass., manufacturer of radiators, is about to place a foundry addition into service and has been buying some equipment for this purpose. One of the most recent items was a sand separator from the Royer Foundry & Machine Co., Wilkes-Barre, Pa. S. M. Howes Co., Boston, recently purchased sand blast equipment and a ventilating system. New equipment will be required for the rehabilitation of the foundry of the Arnold Co., Norwalk, Conn., which recently was sold. The Crane Co., Bridgeport, Conn., has purchased dust arrester equipment for installation in their plant.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

The Hartford Molded Products Co., Hartford, Conn., has been incorporated with $100,000 capital, to produce metallic molded products, by Harrison B. Freeman and others of Hartford.

Indiana Steel & Wire Co., Muncie, Ind., has awarded contracts for brick and steel building for annealing department. A machine shop also is to be constructed.

Shreveport Railways Co., Shreveport, La., will construct a new car barn including new machine shop and foundry. Bradford Hearn is superintendent.

Malcolm Foundry Co., Inc., Newark, N. J., has been incorporated for $25,000 by John Williams, Harold T. and Thomas Malcolm, 67 Polk street.

The Carolina Machine Co., Dayetteville, N. C., soon will start constructing a foundry according to C. G. Russell, president. All equipment for the proposed plant has been purchased.

The American Foundry Co., Hot Spring, Ark., recently incorporated, plans constructing a foundry here for production of gray iron castings. W. F. Fullington is president and T. M. Fullington vice president and general manager.

Emerson Pattern Co., New York, has been formed with $10,000 capital, to manufacture wood and metal patterns, by R. A. Allen, J. Sebo and W. Emerson, Jr., with H. S. Goodspeed, 522 Fifth avenue, as attorney.

Louisville & Nashville railroad has awarded contracts to Roehl & Corbin, Knoxville, Tenn., for machine shop and repair shop at Corbin, Ky. J. C. Haley, Louisville & Nashville, Louisville, Ky., is architect. *Noted Sept.* 1.

Wisconsin Pump & Mfg. Co., 301 Gay building, Madison, Wis., has plans for 1-story, concrete block plant for manufacturing gasolene pumps. W. M. Harks, 445 West Gilman street, is president. *Noted Sept.* 1.

Gibralter Bronze Co., Cincinnati, has been formed with 1000 shares no par value stock to manufacture bronze, brass and kindred products, by C. L. Shafer, Rober, Black and John P. Errett.

Clare Osborn, Ltd., has been incorporated in Toronto, Ont., to manufacture wood and iron products and carry on business of iron founder, etc., with $50,000 capital, by Clare V. Osborn, James G. Smith and Neil Sinclair.

The Thomasville Iron Works, Thomasville, Ga., is reported as inquiring for a 1 to 3-ton electric furnace for steel castings. C. L. Thompson is secretary of the company. The company operates gray iron, brass and aluminum foundries.

Franklin Foundry Corp., St. Louis, has been incorporated with $15,000 capital stock, to manufacture and deal in iron castings of all kinds. A. J. Fauck is president and incorporator. Mary Fauck and Herman Weibel also are incorporators.

American Radiator Co., Buffalo, N. Y., plans constructing 1 and 2-story, 24x150-foot foundry addition. E. B. Felix has been awarded the general contract. Thomas Potts is superintendent of the American company at Litchfield, Ill., where the new addition will be constructed.

Hale Fire Pump Co., Conshohocken, Pa., recently started work on a 1-story foundry for the production of brass castings. The company purchased the Scotia Brass Co. foundry recently and now is operating that works. *Noted Sept.* 1.

St. Louis Brass & Iron Works, Inc., has started operating its plant at Spokane, Wash. where it expects to develop a capacity of 7500 tons and 6500 tons of bronze and iron castings. Brass and aluminum castings also will be produced. A. E. Binder is president and general manager.

Fortuna Oil Co., Shreveport, La., is completing a modern machine shop, foundry and warehouse building on the Mooringsport road, where all kinds of oil field repair work will be handled. The machine shop and warehouse is to be 70x140 feet and the foundry building 60x 60 feet.

St. Louis Tool, Die & Mfg. Co., St. Louis, has been formed with $100,000 capital, to manufacture and sell automobile and motor boat accessories, and iron, steel and other metallic castings. Greensfelder & Grand, Central National Bank building, St. Louis, are attorneys, and E. A. Cowdery, L. H. Cowdery, Hal L.

Coleman and W. L. McCann are incorporators.

National Malleable & Steel Castings Co., 546 South Holmes avenue, Indianapolis, Ind., has awarded construction contracts to Hall Construction Co., Board of Trade building, that city, for 1-story, 93x630-foot plant of steel and concrete. The new plant will be used for annealing purposes. *Noted Aug.* 1.

National Malleable & Steel Castings Co. has awarded contracts for constructing 1-story, 100x190-foot shop at South Dock street, Sharon, Pa.

The Paulson Tools, Inc., Wallingford, Conn., has awarded contracts for constructing 1-story, 36x80-foot forge and machine shop.

The Eastern Malleable Iron Co., Bridgeport, Conn., is inquiring for equipment for expanding its Vulcan Works. A 5-ton electric crane is one of the items needed.

Southern Railway System plans installation of a modern foundry in improvements to be made at the plant at South Richmond, Va. F. S. Wynn, Washington, D. C., headquarters of the company, is vice president.

Plattsburg Foundry & Machine Co., Plattsburg, N. Y., is reported as inquiring for machine tools, including many items. G. Rotherwek is purchasing agent. The company operates gray iron, brass and aluminum foundries.

American Locomotive Co., 30 Church street, New York, plans extensive addition to its plant at Schenectady, N. Y. One detail of the expansion calls for crane runway work in one of its foundry yards.

The Arkansas Foundry Co., Litle Rock, Ark., is reported to be planning rebuilding portion of its plant at East Sixth street recently damaged by fire. The company specializes in manufacture of brass, bronze and kindred metal products.

New Trade Publications

CHAIN DRIVE—Power transmission by silent chain is treated in a pamphlet by the Ramsey Chain Co., Albany, N. Y.

VIBRATOR—An unbalanced vibrator is described in a folder recently issued by the Hanna Engineering Works, Chicago. The various outstanding features of the device are discussed.

FLOORS—Stair treads and floors to prevent slipping and falling are illustrated in a bulletin by the Norton Co., Worcester, Mass. A wide variety of construction for various purposes is illustrated.

REFRACTORIES—Charts, formulas and tables of general interest are being issued in bulletin form twice monthly by the service department of the Crescent Refractories Co., Curwensville, Pa.

DRILLS—The Cleveland Twist Drill Co., Cleveland, has published a pamphlet describing and giving results on a series of tests conducted with drills. The tests dealt with various speeds and feeds.

PLASTIC WOOD—A plastic wood manufactured by Necol Industrial Collodions, Ltd., London, England, and sold in the United States by Charles Tennant Sons & Co., New York, is described in a recently published pamphlet.

PANS—The Clearfield Machine Shops, Clearfield, Pa., has issued a pamphlet describing pans for reducting and tempering soft clay, shale, flint, magnesite, ganister, molding sand, core sand, coke breeze, etc.

SANDING MACHINERY—A bulletin by the Porter-Cable Machine Co., Syracuse, N. Y., describes a double spindle sander for use on intricate internal work at varying radii. Two heads are equipped with separate motors operated independently. The machine is of rugged construction for heavy work.

CARBON PRODUCTS—A loose leaf catalog of the products of the National Carbon Co., Cleveland, has been distributed to the trade. It is larger than its predecessors, additional products have been included and the technical side of brush operations has been given greater emphasis.

BARROWS—Information of value to those having wheelbarrow problems to solve is presented in a catalog of the Cleveland Wheelbarrow & Mfg. Co., Cleveland, O. The book is well illustrated with views of the various types of barrows and specifications are included.

FIRE CEMENT—A refractory bond for fire brick, one of the products of the Harbison-Walker Refractories Co., Pittsburgh, is the subject of a finely illustrated booklet just issued by that company. Various uses of the material in numerous branches of industry are outlined.

VACUUM PUMPS—A bulletin by the Chicago Pneumatic Tool Co., New York, devoted to a discussion of vacuum production gives a full description of the devices produced by that company for the exhaustion of air.

HANDLING EQUIPMENT—Overhead trucking for industrial plants is described and illustrated in a recent folder of the Cleveland Electric Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, O. Several views show this system installed in foundries.

PUMPS—Various pumps, turbines, valves and screens produced by the D'Olier Centrifugal Pump & Machine Co., New York, engineer and manufacturer, are illustrated and briefly described in a four-page circular recently distributed by that company.

SPEED TRANSFORMER—The Hill Clutch Machine & Foundry Co., Cleveland, has issued a folder describing a spur gear speed transformer for use where a condensed power drive is needed and two speeds required. The transformer is made in seven sizes, the horsepower and speed in revolutions per minute being given.

HEATER—A portable heating unit with fan attached is described in a pamphlet issued by the Buffalo Forge Co., Buffalo. This heater is attached to the steam line and the heat radiated from the coils is driven through the shop by the electric fan. Heating capacities and dimensions are given.

REFRACTORY CEMENT—Selection of a suitable refractory cement for furnace relining, together with the problems of shrinkage, chemical action, shocks, temperature, etc., are discussed in a booklet recently issued by the Fusetite Corp., Ebensburg, Pa., manufacturer of refractory cement.

APPRAISALS—"The Property Owners Handbook" is the title of a new 32-page booklet issued by the American Appraisal Co., Milwaukee. This booklet is the record of 38 uses of appraisals over and above the usual major applications of appraisal reports as embodied in requirements of insurance, accounting, taxation, etc.

WELDING AND CUTTING EQUIPMENT—Various types of acetylene generators are described and illustrated in a 48-page catalog published by the Oxweld Acetylene Co., Chicago. Other welding and cutting equipment is described including heating and cutting blowpipes, regulators, gages, manifolds, decarbonizing outfits, hose connections, tables, trucks, etc.

STARTERS—The Allen-Bradley Co., Milwaukee, has issued a series of four pamphlets describing alternating current resistance starters, semiautomatic resistance starters, automatic resistance starters and across the line starting switch. All of the pamphlets are illustrated with views of the types of starters and the important features of each machine are given.

ELECTRIC MELTING POTS—Application of electricity to heating metals in pots where automatic control of temperature is desirable is described in a bulletin by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The pots described are designed for use with babbitt metal, solder, lead and others with melting point between 450 and 950 degrees Fahr.

ELECTRIC FURNACES—In a bulletin by the Electric Furnace Construction Co., Philadelphia, are described various devices for the application of electricity in the form of heat to a wide range of purposes. These uses include steam generation to heat-treating and annealing furnaces and the furnaces designed for melting or smelting metals. Typical installations are shown.

POLYPHASE MOTORS—Century Electric Co., St. Louis, manufacturer of motors, in its bulletin No. 35, recently issued. presents details of its squirrel cage induction polyphase motors. The design and construction of the motors together with accessories are fully described and illustrated. An enclosure in the catalog presents a graph showing the automatic start induction feature of the motors.

REFRACTORIES—General Refractories Co., Philadelphia, in a comprehensive and handy booklet recently distributed, lists in complete and concise tables, the standardized chrome brick shapes, temperature comparisons, fusing points, and other information both useful and time saving. Reproductions of pictures of bricks according to specifications and views of the various plants of the General Refractories Co. are used to illustrate the booklet.

BELT CONVEYORS—Continuous mechanical handling of bulk materials is described in a catalog by the Brown Hoisting Machinery Co., Cleveland, featuring belt conveyors for various purposes. While some individual installations are illustrated the catalog is devoted principally to descriptive information of the equipment developed by this company. Sufficient general data are offered to aid in selection of the most suitable equipment for a particular purpose.

HOISTS—The Alfred Box & Co., Inc., Philadelphia, has issued a 32-page booklet describing a small hoist of 500 to 1000 pound lifting capacity. The various designs in this type of hoist are illustrated, and the important construction features discussed. Other equipment made by the Box company, such as current collectors, current conductor supports, monorail electric hoists with grab bucket, traveling cranes and jib cranes are described and a number of views are shown of installations.

COMBUSTION CONTROL—Carrick Engineering Co., Chicago, manufacturer of boiler plant equipment and combustion engineer, has described thoroughly the various methods and systems of automatic control of combustion, in a 32-page treatise recently issued. This booklet analyzes the conditions and problems presented in co-ordinating supply of steam with the demand, and illustrates the discussion with many charts and graphs. In a 16-page bulletin enclosed in the same binder the Carrick company publishes complete specifications together with diagrams and list of equipment for the 33 methods of automatically controlling boiler room equipment.